DU M.Sc. ENTRANCE CHEMISTRY PAPER-2019

1. Specific Redox reaction of chlorine is known as
(a) reduction (b) redox chlorination (c) disproportionation (d) oxidation

2. Which of the following is not a standard condition?
(a) 1 mol dm^{-3} solutions (b) 100 atm
(c) 100 kPa (d) 298 K

3. Which transitions are studied by UV spectrophotometer?
(a) Rotational (b) Electronic (c) Vibrational (d) Nuclear

4. Which electrode(s) may be used to determine the pH of a solution?
(a) Quinhydrone electrode (b) Hydrogen electrode
(c) All of the above (d) Glass electrode

5. Which acid is present in lemon?
(a) latic acid (b) tartaric acid (c) citric acid (d) marlic acid

6. Gram molecular volume of oxygen at STP is
(a) 11200 cm^3 (b) 22400 cm^3 (c) 5600 cm^3 (d) 3200 cm^3

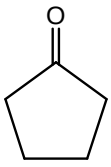
7. Glucose does not react with
(a) HCN (b) $NaHSO_3$ (c) $C_6H_5NHNH_2$ (d) $H_2N–OH$

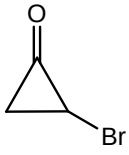
8. Which does not increase rate by affecting the number or nature of collisions?
(a) adding a catalyst (b) increasing the surface area
(c) increasing the pressure (d) increasing the temperature

9. If AgI crystallizes in zinc blende structure with I^- ions at lattice points, what fraction of tetrahedral voids is occupied by Ag^+ ions?
(a) 75% (b) 25% (c) 50% (d) 100%

10. Which carbonyl compound has maximum dipole moment?

(a) 

(b) 

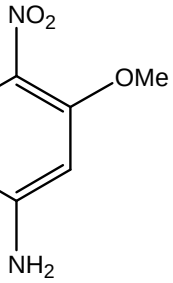
(c) 

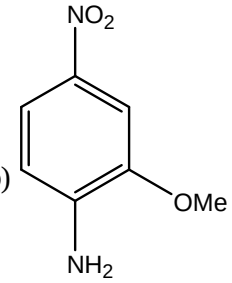
(d) 

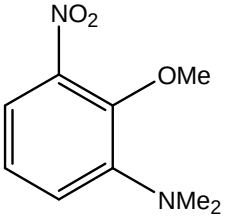
11. Identify the wrong statement in the following
(a) Atomic radius of the elements decreases as one moves across the left to right in the 2nd period of the periodic table.
(b) Atomic radius of the elements increases as one moves down the first group of the periodic table
(c) Amongst isoelectronic species, greater the negative charge on the anion, larger is the ionic radius
(d) Amongst isoelectronic species, smaller the positive charge on the cation, smaller is the ionic radius

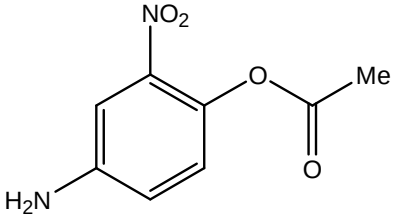
12. The structure of sulphur dioxide molecule (SO_2) may be given as
(a) Linear (b) Bent (c) Octahedral (d) Tetrahedral

13. The structure of the compound that matches the ^1H NMR data given below:
^1H NMR(DMSO-d_6): δ7.75(dd, J = 8.8, 2.4 Hz, 1H), 7.58 (d, J = 2.4 Hz, 1H), 6.70 (d, J = 8.8 Hz, 1H), 6.50 (brs, 2H), 3.80 (s, 3H)

(a) 

(b) 

(c) 

(d) 

14. A mixture of $CaCl_2$ and NaCl weighing 4.44 g is treated with sodium carbonate solution to precipitate all the Ca^{2+} ions as calcium carbonate. The calcium carbonate so obtained is heated strongly to get 0.56 g of CaO. The percentage of NaCl in the mixture (atomic mass of Ca = 40) is
(a) 70 (b) 75 (c) 25 (d) 30.6

15. Which pair of species is listed in increasing order of the property given?
(a) Ionization energy : O, F (b) Covalent character: HI, HBr
(c) Melting point: I_2, Br_2 (d) Radius: Te^{2-}, Te^{4+}

16. The material, whose dimensions can be changed upon the application of an electric field is called
(a) Ferromagnetic (b) Ferroelectric (c) Piezoelectric (d) Pyroelectric

17. In the case of a particle in a one-dimensional box, the energy of an energy state is given by

(a) $E_n = \frac{8n^2h^2}{ma^2}$, where $n = 1, 2, 3, ...$ (b) $E_n = n^2h^2\left(8ma^2\right)$, where $n = 1, 2, 3, ...$

(c) $E_n = \frac{n^2h^2}{8ma^2}$, where $n = 1, 2, 3, ...$ (d) $E_n = \frac{n^2h^2a^2}{8m}$, where $n = 1, 2, 3, ...$

18. How many chiral carbon atoms are present in 2, 3, 4-trichloropentane?
(a) 2 (b) 1 (c) 3 (d) 4

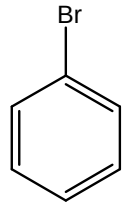
19. The process of heating the concentrated ore in a limited supply of air or in absence of air is known as
(a) Cupellation (b) Roasting (c) Calcination (d) Leaching

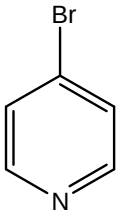
20. Spectroscopic transitions leading to bending of bond angles in molecules will appear at which region of the electromagnetic spectrum?
(a) Radiofrequency (b) Infra-red (c) Microwave (d) Ultraviolet

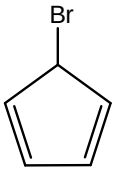
21. Oxidation product of quinoline with $KMnO_4$ is
(a) Phthalic anhyride (b) Phthalic acid (c) Nicotinic acid (d) None of these

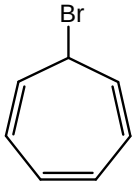
22. The IUPAC name for the complex $[Co(NO_2)(NH_3)_5]Cl_2$ is
(a) nitrito-N-pentaamminecobalt (II) chloride (b) nitrito-N-pentaamminecobalt (III) chloride
(c) pentaammine nitrito-N-cobalt (III) chloride (d) pentaammine nitrito-N-cobalt (II) chloride

23. The compound that gives precipitate on warming with aqueous $AgNO_3$ is

(a) 

(b) 

(c) 

(d) 

24. The one which decreases with dilution is
(a) Specific conductance (b) Molar conductance (c) Conductance (d) Equivalent conductance

25. The standard emf of galvanic cell involving 3 moles of electrons in its redox reaction is 0.59 V. The equilibrium constant for the reaction of the cell is
(a) 10^{25} (b) 10^{20} (c) 10^{30} (d) 10^{15}

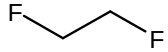
26. The oxidation state of Cr in $[Cr(NH_3)_4Cl_2]^+$ is
(a) 2 (b) 0 (c) 1 (d) 3

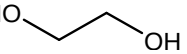
27. Activated charcoal is used to remove colouring matter from pure substance. It works by
(a) absorption (b) adsorption (c) reduction (d) oxidation

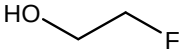
28. Which type of colloid is the dissolution of sulphur (S_8)
(a) Micelle (b) Multimolecular colloid
(c) Associated colloid (d) Macromolecular colloid

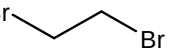
29. For the given complex $[CoCl_2(en)(NH_3)_2]^+$, the number of geometrical isomers, the number of optical isomers and total number of isomers of all type possible respectively are
(a) 0, 1, 3 (b) 0, 2, 2 (c) 2, 2, 3 (d) 3, 3, 4

30. A covalent molecule AB_3 has pyramidal structure. The number of lone pair and bond pair electrons in the molecule are respectively
(a) 2 and 2 (b) 1 and 3 (c) 0 and 4 (d) 3 and 1

31. Among the following compounds the compounds having anti-conformation as most stable conformation
(a) 

(b) 

(c) 

(d) 

32. In which of the following octahedral complexes of Co(atomic no. 27), will the magnitude of Δ_0 be the highest?

(a) $\left[Co(NH_3)_6\right]^{3+}$ (b) $\left[Co(CN)_6\right]^{3-}$ (c) $\left[Co(H_2O)_6\right]^{3+}$ (d) $\left[Co(C_2O_4)_3\right]^{3-}$

33. Hydroxyl ion concentration of 1M HCl is

(a) 1×10^{-13} mol dm^{-3} (b) 1×10^{14} mol dm^{-3} (c) 1×10^{-1} mol dm^{-3} (d) 1×10^{1} mol dm^{-3}

34. The unit of rate constant for a zero order reaction is

(a) s^{-1} (b) mol $dm^{-3}s^{-1}$ (c) $mol^{-1}\ dm^3s^{-1}$ (d) $mol^{-2}\ dm^6s^{-1}$

35. Using the basic phase rule equation, find out which of the following is a correct representation of the degrees of freedom (F) of a system
(a) F = 0, for a two-component system with two phases in equilibrium
(b) F = 2, for a one-component system with two phases in equilibrium
(c) F = 3, for a two-component system with two phases in equilibrium
(d) F = 1, for a one-component system with two phases in equilibrium

36. What is the unit of specific conductance (or conductivity) of a conductor?
(a) Siemens^{-1} cm (b) Siemens^{-1} cm^{-1} (c) Siemens cm^{-1} (d) Siemens cm

37. The addition of a catalyst during a chemical reaction alters which of the following quantities?
(a) Internal energy (b) Activation energy (c) Enthalpy (d) Entropy

38. A ligand can also be regarded as
(a) Lewis base (b) Lewis acid (c) Bronsted base (d) Bronsted acid

39. When a solute is distributed between two immiscible liquids, on which of the following parameters the value of partition co-efficient (K_D) depends?
(a) Amount of solute (b) Relative amount of two solvents
(c) Temperature (d) Pressure

40. The equation that relates the change in the equilibrium constant, K_{eq}, of a chemical reaction to the change in temperature, T, is known as
(a) Wilhemy's equation (b) Sackur-Tetrode equation
(c) Mark-Houwink equation (d) Van't Hoff equation

41. Milk is a colloidal system in which
(a) Water is dispersed in fat (b) Fat is dispersed in water
(c) Fat is dissolved in water (d) None of these

42. In a body-center cubic (BCC) type of crystal lattice, the number of atoms belonging exclusively to each unit cell within the lattice is/are
(a) 2 (b) 1 (c) 3 (d) 4

43. What quantity will remain unchanged for a sample of gas in a sealed rigid container when it is cooled from 100ºC to 75ºC at constant volume?
(a) The pressure of the gas (b) The average energy of the molecules
(c) The average speed of the molecules (d) The density of the gas

44. The number of independent modes of vibration in a non-linear molecule having N atoms is
(a) 3N–3 (b) 3N (c) 3N–5 (d) 3N–6

45. 10 cm^3 of NaOH solution of pH 12 is mixed with 990 cm^3 of water. What is the pH of the resulting solution?
(a) 11 (b) 1 (c) 10 (d) 3

46. Degeneracy of 1st excited state of a particle in 2-D rectangular box with sides 'a' and '2a' is
(a) 2 (b) 0 (c) 1 (d) 3

47. Today the concentration of green house gases is very high because of
(a) Increase in combustion of oil and coal (b) Use of refrigerator
(c) Deforestation (d) All of the above

48. A system maintaining same pressure is known as
(a) Isochoric system (b) Isothermal system (c) Isotonic system (d) Isobaric system

49. The term PVC used in the plastic industry stands for
(a) Phosphavinyl chloride (b) Phosphorvanadium chloride
(c) Polyvinyl carbonate (d) Polyvinyl chloride

50. A compound is formed by elements A and B. This crystallises in the cubic structure where the A atoms are at the corners of the cube and B atoms are at the body centres. The simplest formula of the compound is

(a) AB_4 (b) AB (c) A_8B_4 (d) A_6B

51. What type of light scattering involves iteraction of photons with acoustic phonons in solids?

(a) Compton scattering (b) Mie scattering
(c) Rayleigh scattering (d) Brillouin scattering

52. The correct expression for the Freundlich adsorption equation involving 'x' mass of gas adsorbed on 'm' mass of adsorbent at pressure 'p', with 'k' and 'n' as constants for the given pair of adsorbate and adsorbent, is

(a) $\left(\frac{x}{m}\right) = k\ p^{1/n}$ (b) $\left(\frac{x}{p}\right) = k\ m^{n}$ (c) $\left(\frac{x}{p}\right) = k\ m^{1/n}$ (d) $\left(\frac{x}{m}\right) = k\ p^{n}$

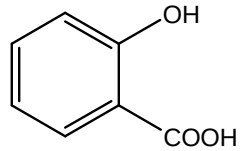
53. The isotope atoms differe in?

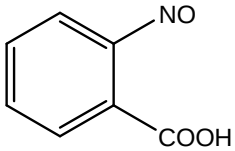
(a) atomic weight (b) number of neutrons
(c) number of electrons (d) atomic number

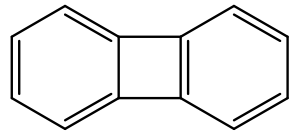
54. It takes 15 minutes for the concentration of a radioactive species to decay to its $1/8^{th}$ value of its original concentration. What is the rate constant of this radioactive decay reaction?

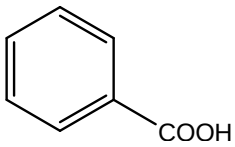
(a) 865.8 s^{-1} (b) 0.001155 s^{-1} (c) 600 s^{-1} (d) 0.00231 s^{-1}

55. Anthranilic acid, on treatment with iso-amyl nitrite furnishes a product which displays a strong peak at 76 (m/e) in its mass spectrum. The structure of the product is

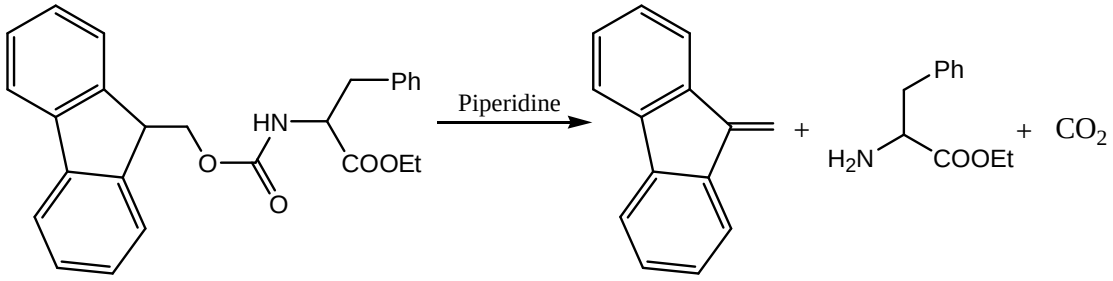
(a) 

(b) 

(c) 

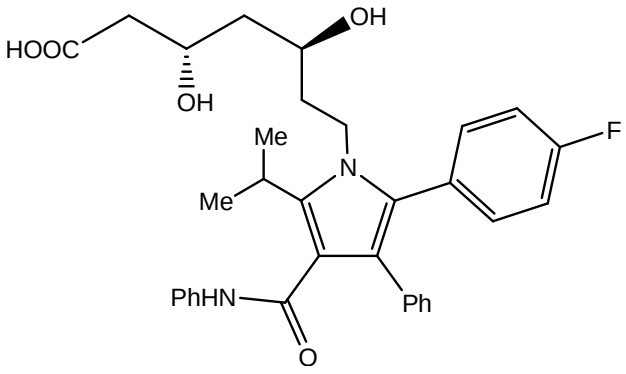
(d) 

56. The mechanism involved in the following reaction is



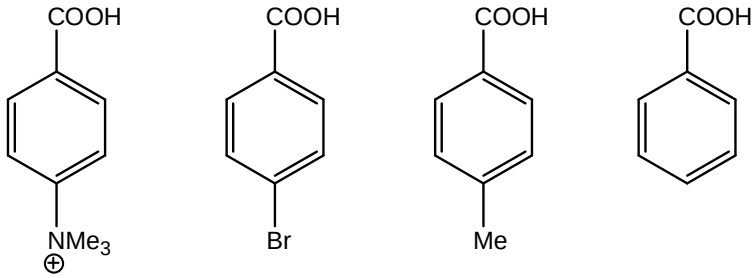
(a) E1CB–elimination (b) E2-elimination (c) E1-elimination (d) Syn-elimination

57. Atorvastatin (structure given below) is a



(a) Cholesterol lowering drug (b) Blood sugar lowering drug
(c) Anti-plasmodial drug (d) Anti-HIV drug

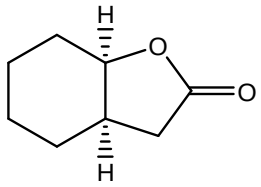
58. Arrange the following in decreasing order of acidity



(I) **(II)** **(III)** **(IV)**

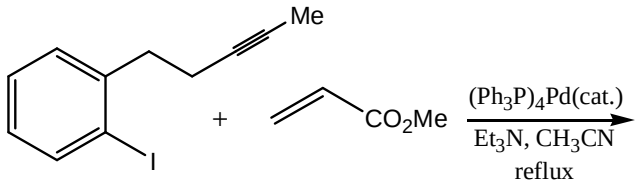
(a) III > II > IV > I (b) II > IV > I > III (c) II > I > IV > III (d) I > II > IV > III

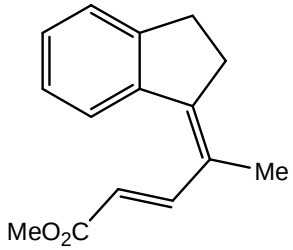
59. In the IR spectrum, carbonyl absorption band for the following compound appears at

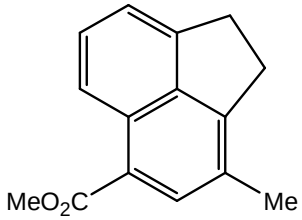


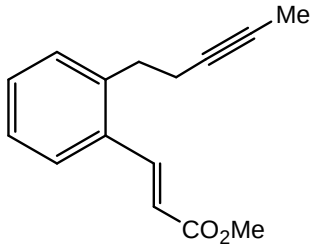
(a) 1810 cm^{-1} (b) 1710 cm^{-1} (c) 1730 cm^{-1} (d) 1690 cm^{-1}

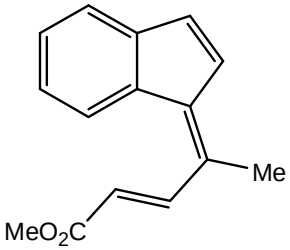
60. Find the major product of the following reaction:



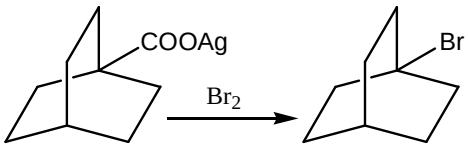
(a) 

(b) 

(c) 

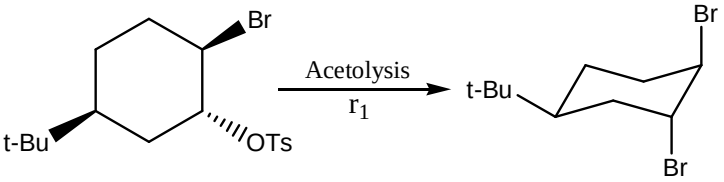
(d) 

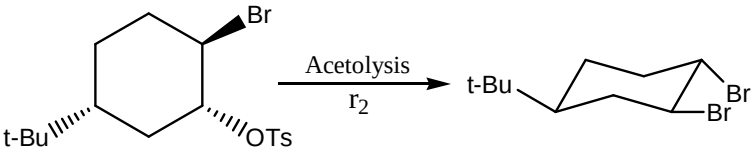
61. Following reaction goes through:



(a) carbene intermediate
(b) free radical intermediate
(c) carbocation intermediate
(d) carbanion intermediate

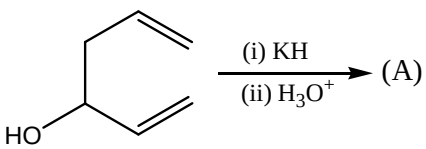
62. Which of the following is correct?

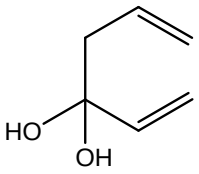


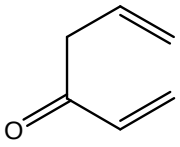


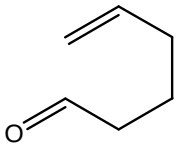
(a) $r_2 > r_1$ (b) $r_1 > r_2$ (c) $r_1 = r_2$ (d) All are correct

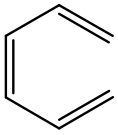
63. Find product (A) of the below reaction is



(a) 

(b) 

(c) 

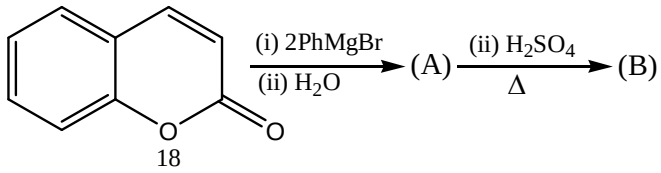
(d) 

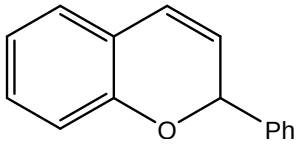
64. Match the following:

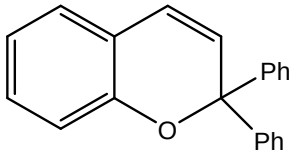
Column-I	**Column-II**
(A) NMR spectroscopy	(I) Quadruple splitting
(B) Raman spectroscopy	(II) Binding energy
(C) Mössbauer spectroscopy	(III) Polarizability Ellipsold
(D) Photoelectron spectroscopy	(IV) Larmor Precession

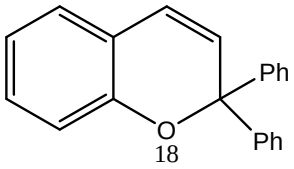
(a) A= IV, B = III, C = II, D = I
(b) A = IV, B = III, C = I, D = II
(c) A = II, B = IV, C = I, D = III
(d) A = III, B = IV, C = I, D = II

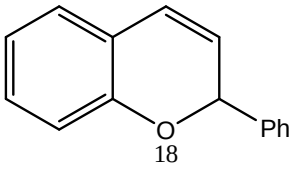
65. Product (B) in the following reaction is



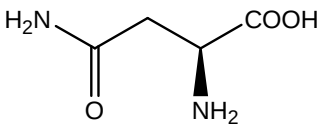
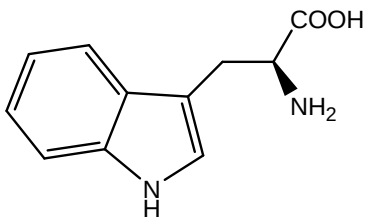
(a) 

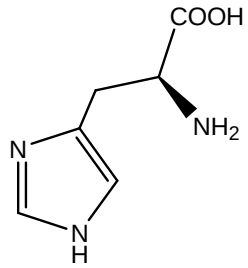
(b) 

(c) 

(d) 

66. Match the amino acids with structures:

Column-I	**Column-II**
(I) 	(A) tryptophan
(II) 	(B) histidine

(III) 

(C) Asparagine

(D) Serine

(E) Glutamic acid

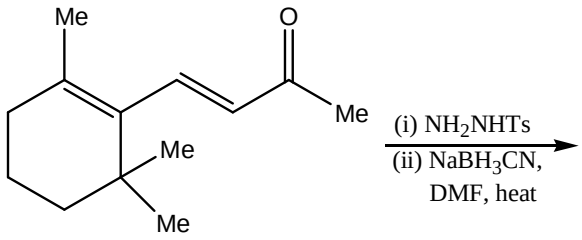
(a) I-C, II-A, III-B

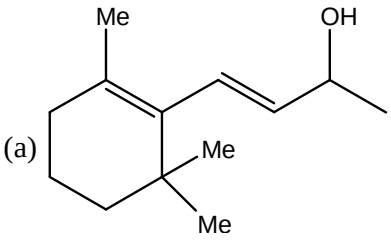
(b) I-C, II-D, III-B

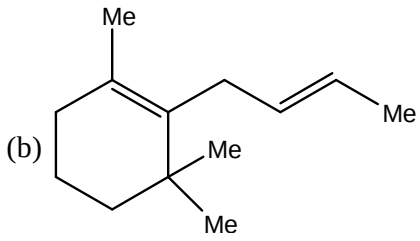
(c) I-A, II-E, III-C

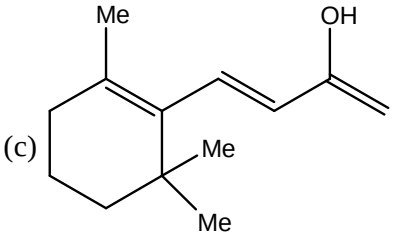
(d) I-A, II-B, III-D

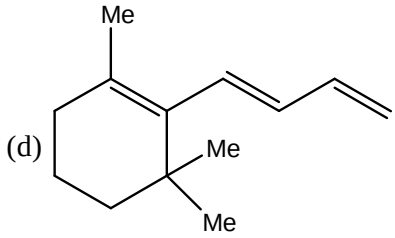
67. Find out the major product of the following reaction is



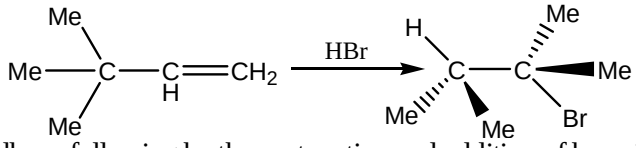
(a) 

(b) 

(c) 

(d) 

68. Consider the addition of HBr to 3, 3-Dimethyl-1-butene shown below. What is the best mechanism explanation for the formation of the observed product?



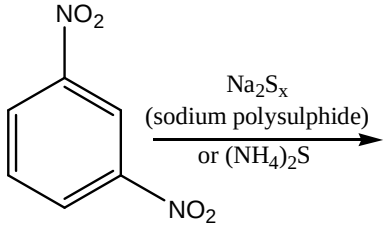
(a) Double bond shift in the alkene following by the protonation and addition of bromide to the carbocation.

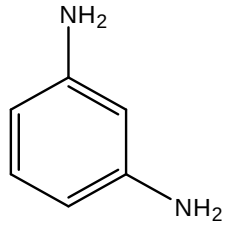
(b) Protonation of the alkene followed by a hydride shift and addition of bromide to the carbocation

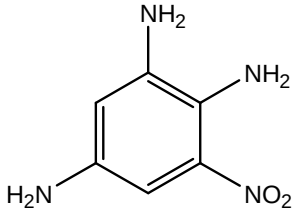
(c) Protonation of alkene followed by a methyl shift and addition of bromide to the carbocation

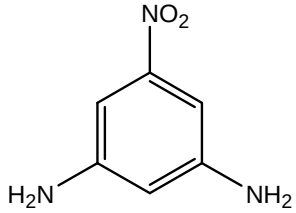
(d) Addition of bromide to the alkene followed by a double bond shift and protonation

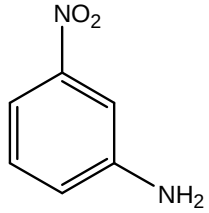
69. Find major product of the following reaction:



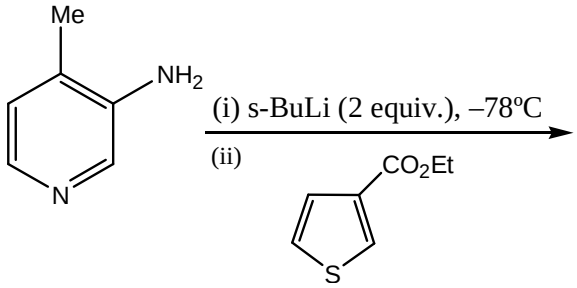
(a) 

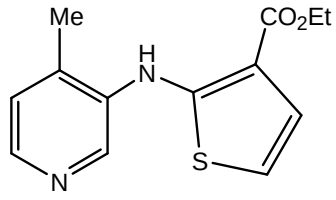
(b) 

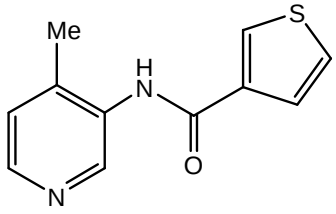
(c) 

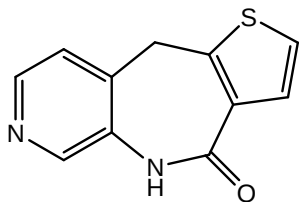
(d) 

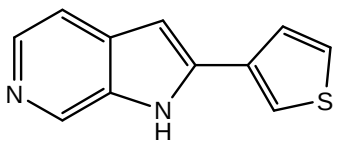
70. Find the major product of the given reaction



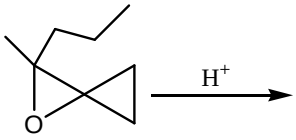
(a) 

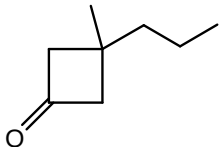
(b) 

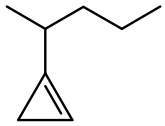
(c) 

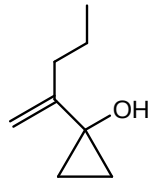
(d) 

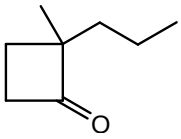
71. The major product formed in the following reaction is



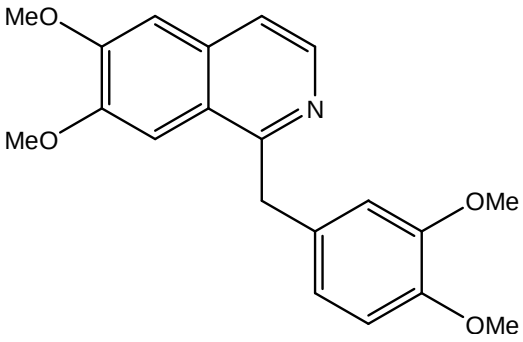
(a) 

(b) 

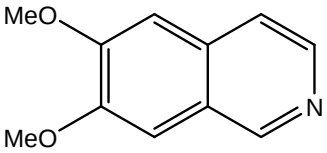
(c) 

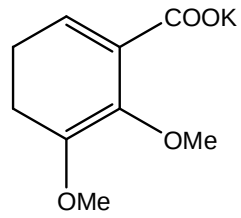
(d) 

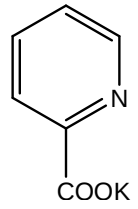
72. Papaverine on oxidation with potassium permanganate gives a ketone, which on fusion with potassium hydroxide gives



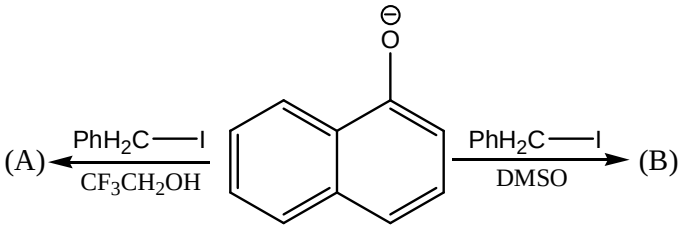
(a) None of these

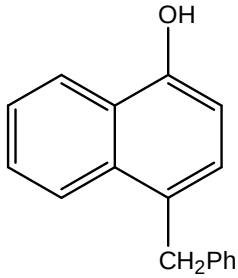
(b) 

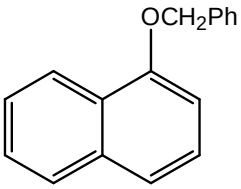
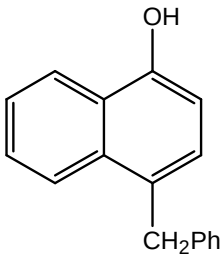
(c) 

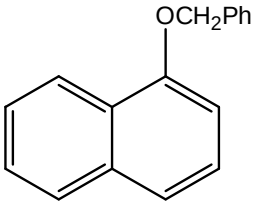
(d) 

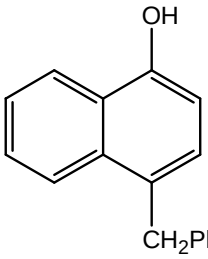
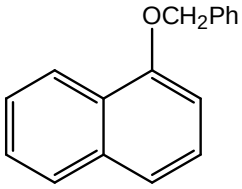
73. (A) and (B) are respectively



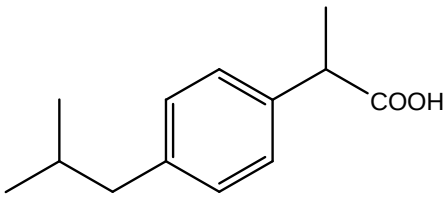
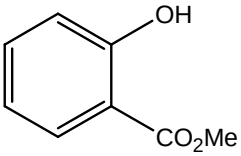
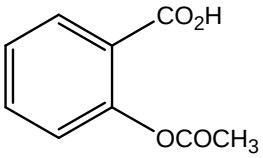
(a) A = B = 

(b) A =  B = 

(c) A = B = 

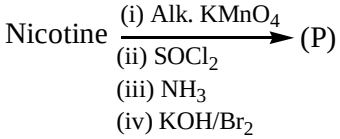
(d) A =  B = 

74. The correct match for the compounds in Column-A with the description in Column-B is

Column-A	**Column-B**
(P) 	(X) Oil of wintergreen
(Q) 	(Y) Aspirin
(R) 	(Z) Ibuprofen

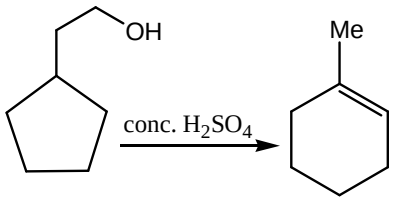
(a) P-y, Q-Z, R-X (b) P-Z, Q-Y, R-X (c) P-Z, Q-X, R-Y (d) P-X, Q-Z, R-Y

75. The product (P) in the following reaction is



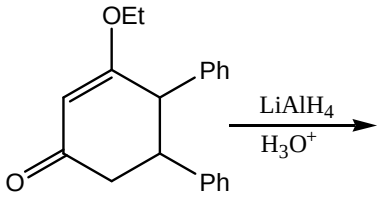
(a) 2-amino-pyridine (b) 2-amino-nicotinamide
(c) 3-amino-pyridine (d) 3-amino-nicotinic acid

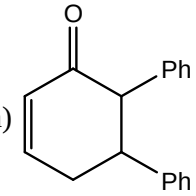
76. How many 1, 2-shift are involved during the course of the following reaction:

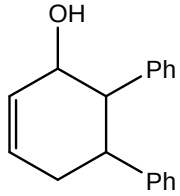


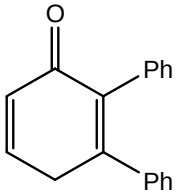
(a) 2 (b) 1 (c) 3 (d) 4

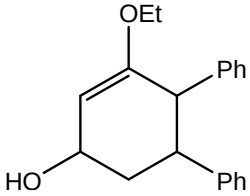
77. Find out the major product



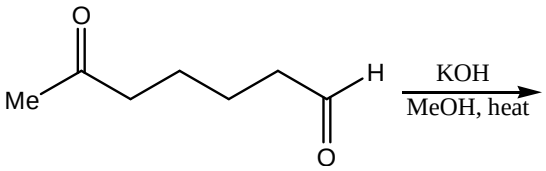
(a) 

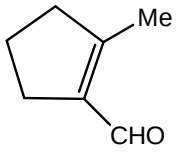
(b) 

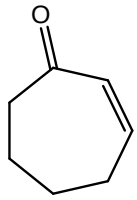
(c) 

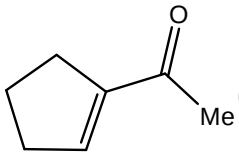
(d) 

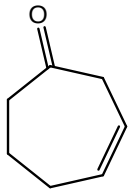
78. Find major product of the following reaction:



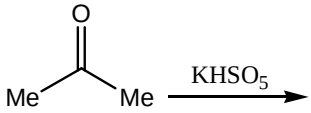
(a) 

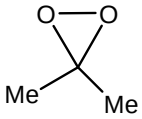
(b) 

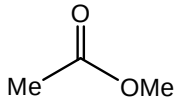
(c) 

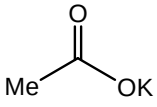
(d) 

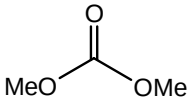
79. Find major product of the below reaction is



(a) 

(b) 

(c) 

(d) 

80. For a reaction between two ionic species dissolved in a solvent, the rate constant relies on which factor(s)?

(a) Charge of the both the ions (b) Dielectric cosntant of the solvent

(c) All of the above (d) Ionic strength of the solution

81. For a crystal, the angle of diffraction (2θ) is 90° and the second order line has a d value of 2.28Å. The wavelength (in Å) of X-rays used for Bragg's diffraction is
(a) 1.613 (b) 2.28 (c) 1.00 (d) 4.00

82. The magnetic moment (spin only) of $[NiCl_4]^{2-}$ is
(a) 5.46 BM (b) 1.82 BM (c) 1.41 BM (d) 2.82 BM

83. Total spin angular momentum of nd^{10} electronic system is (a.u.)
(a) 0 (b) 1/4 (c) 1 (d) 1/2

84. Electronic transitions originating from the 2S energy level of the hydrogen atom to higher levels belong to which series?
(a) Bracket series (b) Lyman series (c) Pfund series (d) Balmer series

85. Which of the following indicators cannot be used in the redox potentiometric titrations?
(a) Nile red (b) Methylene blue (c) Erioglaucine A (b) Quinhydrone

86. Which of the following represent the correct bond orders for N_2, N_2^+ and N_2^- molecules?
(a) 3.0, 2.5, 2.5 (b) 3.0, 2.0, 2.5 (c) 3.0, 3.0, 3.0 (d) 2.5, 2.5, 2.5

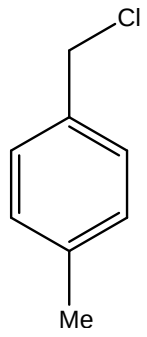
87. Which of the following equations is used in the calculation of the equilibrium constant (K)?

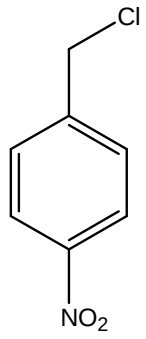
(a) $\ln(K) = -\left(\frac{RT}{nEF^0}\right)$ (b) $\ln(K) = \left(\frac{nFE^0}{RT}\right)$

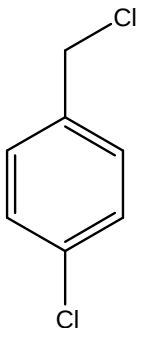
(c) $\ln(K) = -\left(\frac{nFE^0}{RT}\right)$ (d) $\ln(K) = \left(\frac{RT}{nFE^0}\right)$

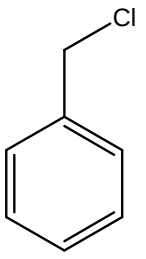
88. Which of the following molecules give pure rotational spectra?
(a) O_2, CH_4 (b) H_2, HCl (c) H_2, CO (d) HCl, CO

89. Which of the following is most reactive towards S_N2 reaction?

(a) 

(b) 

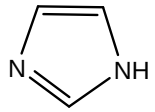
(c) 

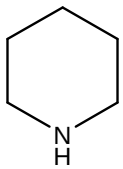
(d) 

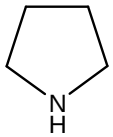
90. Which of the following indicates the incorrect limiting value of the van't Hoff factor (i) at infinite dilution for strong electrolytes?
(a) HCl = 2 (b) H_2SO_4 = 2 (c) NH_4Cl = 6 (d) $K_4[Fe(CN)_6]$ = 5

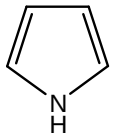
91. Which one of the following Vitamins is essential for coagulation of Blood?
(a) D (b) B1 (c) K (d) C

92. Which one of the following is least basic in character?

(a) 

(b) 

(c) 

(d) 

93. The vibrational energy of a simple harmonic oscillator, as calculated from the Schrodinger equation, depends on

(a) Oscillation frequency
(b) Vibrational quantum number
(c) Planck's constant
(d) All of the above

94. The frequency of 3×10^{18} Hz falls in the

(a) Visible and ultraviolet
(b) Infra-red region
(c) X-ray region
(d) Mirowave region

95. The reduced C–C bond strength/order in Zeise's salt as compared to C–C bond in free ethylene is due to following factor

(a) back bonding or back donation
(b) sp hybridization
(c) quadruple bonding
(d) ionic bonding

96. The correct statement with respect to the complexes $Ni(CO)_4$ and $[Ni(CN)_4]^{2-}$ is

(a) nickel is in the same oxidation state in both
(b) have tetrahedral and square planar geometry, respectively
(c) both have tetrahedral geometry
(d) both have square planar geometry

97. The chemical reaction: $2A + B \rightarrow C + 2D$ is found to be first order with respect to A but second order with respect to B. The rate of the reaction is given by

(a) None of these (b) $k[A][B]^2$ (c) $k[A]^2[B]$ (d) $k[A][B]$

98. Chemical potential is also known as

(a) Partial molar enthalpy
(b) Partial molar volume
(c) Partial molar entropy
(d) None of these

99. Who is regarded as father of modern chemistry?

(a) Einstein (b) Lavoisier (c) C.V. Raman (d) Rutherford

100. ^1H NMR spectrum of a mixture of benzene and acetonitrile shows two singlets of equal integration. The molar ratio of benzene: acetonitrile is

(a) 1 : 2 (b) 1 : 1 (c) 2 : 1 (d) 6 : 1