D.U. M.Sc. CHEMISTRY ENTRANCE - 2016 (Set - A)

Time : 2 Hours **M. Marks: 270**

Instructions:

(*i*) This test booklet contains **90** Multiple Choice Questions.

(*ii*) Each correct answer will be given **3 marks,** and for each incorrect answer **1 mark** will be deducted.

1. Which of the following is the correct order of increasing acidity sequence?
   (a) HI < HBr < HCl < HF (b) HI < HCl < HBr < HF
   (c) HF < HCl < HBr < HI (d) HF ≈ HBr < HCl < HI
2. Which of the following statement is correct?
   (a) only one bond length is observed in both PF_5 and SF_6
   (b) two different bond lengths are observed in both PF_5 and SF_6
   (c) only the equatorial bond lengths are uniform in PF_5 and the axial bond lengths in SF_6
   (d) two different bond lengths are observed in PF_5 and only one bond length in SF_6
3. When $^{23}_{11}Na$ nuclide is bombarded with alpha particles the resultant products will be
   (a) $^{24}_{12}Mg$ and $^{2}_{1}H$ (b) $^{26}_{12}Mg$ and $^{1}_{1}H$ (c) $^{26}_{11}Mg$ and $^{1}_{0}n$ (d) $^{25}_{12}Na$ and $^{1}_{1}He$
4. The magnetic moments of the lanthanoid compounds arise from
   (a) spin-only angular momentum
   (b) only from orbital angular momentum
   (c) both from spin and orbital angular momentum
   (d) all of the above
5. Which is the best way of identifying a given colourless liquid to be water or not?
   (a) by tasting
   (b) by adding methyl orange
   (c) by smelling
   (d) by adding a pinch of copper sulphate
6. The addition of KI and $CuSO_4$ gives
   (a) CuI_2 and K_2SO_4 (b) Cu_2I_2 and K_2SO_4
   (c) K_2SO_4, CuI_2 and I_2 (d) K_2SO_4, Cu_2I_2 and I_2
7. In diborane,
   (a) there exists a direct bond between boron and boron
   (b) all the atoms are in one plane
   (c) the number of electrons in B-H-B is formed by two electrons
   (d) the number of electrons in B-H-B is formed by three electrons

8. Which of the following sulphides is not black?
(a) ZnS (b) NiS (c) CoS (d) CuS

9. For a transition metal with seven electrons the effective magnetic moment will be
(a) 3.16 BM (b) 3.87 BM (c) 15 BM (d) 5.92 BM

10. Schottky defects form in a crystal
(a) when unequal number of cations and anions are missing from the lattice
(b) when equal number of cations and anions are missing from the lattice
(c) when cations leave its normal positions in the lattice and move in to interstitial sites
(d) when the density of the crystal is increased

11. Decreasing order of the dipole moments is
(a) $AsH_3 > BiH_3 > SbH_3 > NH_3 > PH_3$ (b) $BiH_3 > SbH_3 > AsH_3 > NH_3 > PH_3$
(c) $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$ (d) $PH_3 > NH_3 > AsH_3 > SbH_3 > BiH_3$

12. The metal ions responsible for N_2 fixation by the enzyme nitrogenase are
(a) Co and Fe (b) Cu and Fe
(c) W and Cu (d) Fe and Mo

13. The speed of the electron is 1.2×10^6 ms^{-1} and the mass of the electron is 9.1×10^{-31} Kg. Its de Broglie wavelength is
(a) 1.46×10^{-10} m (b) 6.07×10^{-15} m
(c) 6.907×10^{-10} m (d) 6.071×10^{-10} m

14. A radioactive element lost 50% activity in 3 days and 20 hrs. The decay constant of the element is
(a) 7.53×10^{-3} hr^{-1} (b) 5.73×10^{-3} hr^{-1}
(c) 7.35×10^{-2} hr^{-1} (d) 9.73×10^{-3} hr^{-1}

15. Which of the following has a higher crystal field splitting energy (Δ_0)
(a) $[Co(CN)_6]^{3-}$ (b) $[Co(NH_3)_6]^{3+}$
(c) $[CoF_6]^{3-}$ (d) $[Co(H_2O)_6]^{3+}$

16. The pH and pOH of 0.1 M H_2SO_4 are
(a) 0.1, 13.9 (b) 0.3, 13.7 (c) 0.7, 13.3 (d) 1.0, 13.0

17. The symmetry possessed by a cubic crystal system, all axes being equal and all angles at 90° is due to the
(a) nine planes of symmetry (b) six two-fold axes (C_2) of symmetry
(c) three four-fold axes (C_4) of symmetry (d) four three-fold axes (C_3) of symmetry

18. The Ziegler-Natta catalysts used for the polymerization of olefins is
(a) TiO_2 and Al_2O_3 (b) $TiCl_3$ and $Al(C_2H_5)_3$
(c) $TiCl_4$ and ZnO (d) $PdCl_4$

19. A delta (δ) bond formation is known in
(a) $Na[Re(CO)_5]$ (b) ReO_3
(c) $[Re_2Cl_8]^{2-}$ (d) $ReOCl_4$

20. The tetragonal elongation resulting in the increase of the two trans M-L bond distances occur in octahedral complexes of transition metal ions with a configuration of
(a) d^{10} (b) d^7 (c) d^2 (d) d^9

21. The increasing order of the observed Infra Red (IR) $\nu_{CO}(cm^{-1})$ among the isoelectronic complexes will be
(a) $[V(CO)_6]^- < Cr(CO)_6 < [Mn(CO)_6]^+$ (b) $[V(CO)_6]^- < [Mn(CO)_6]^+ < Cr(CO)_6$
(c) $Cr(CO)_6 < [V(CO)_6]^- < [Mn(CO)_6]^+$ (d) $[Mn(CO)_6]^+ < Cr(CO)_6 < [V(CO)_6]^-$

22. In methane which of the following symmetry operations will result in a C_2 symmetry operation?
(a) one S_3 and one S_1 operations (b) two S_4 operations
(c) one C_3 and one C_1 operation (d) one C_3 and E operations

23. The poisoning in the Minamata Bay in Japan was due to
(a) compounds of lead (b) methylmercury compounds
(c) arsenic (d) uranium

24. Resistance of solid C_{60} disappears when formed compounds with
(a) K, Rb, Cs (b) S, Se, Te (c) Zn, Cd, Hg (d) Ti, Y, Sc

25. Ground state for d^4 electronic configuration is
(a) ^5F (b) ^5D (c) ^2D (d) ^3F

26. Which of the following elements has a more stable oxidation state of III as compared to an oxidation state of I?
(a) Al (b) Ga (c) Tl (d) B

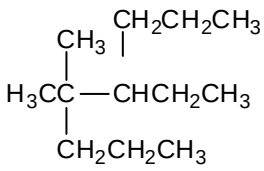
27. The structure of ICl_2 is
(a) linear (b) tetrahedral
(c) trigonal bipyramid (d) octahedral

28. Which of the following materials show Meissner effect?
(a) metallic and paramagnetic (b) superconducting and diamagnetic
(c) semiconducting and diamagnetic (d) antiferromagnetic and insulating

29. The correct increasing order of Trans effects shown by the σ donor ligands is
(a) $OH^- < Br^- < SCN^- < PR_3$ (b) $OH^- < Br^- < PR_3 < SCN^-$
(c) $Br^- < PR_3 < OH^- < SCN^-$ (d) $Br^- < OH^- < SCN^- < PR_3$

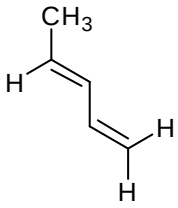
30. Five experimental determinations of Fe in an iron ore by volumetric method gave the percentages 67.48, 67.37, 67.43, and 67.40. The standard, average and probable deviation of the mean are
(a) 0.047, 0.031, 0.036 (b) 0.031, 0.036, 0.047
(c) 0.047, 0.036, 0.031 (d) 0.036, 0.047, 0.031

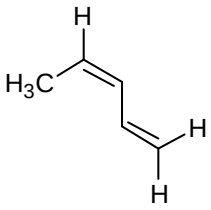
31. The IUPAC name of the following compound is

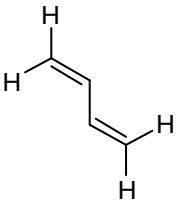


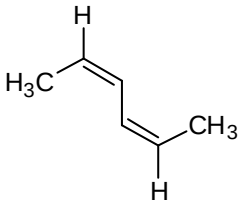
(a) 4, 4-dimethyl-5-ethyloctane (b) 4-ethyl-5, 5-dimethyloctane
(c) 2-methyl-2, 3-dipropylpentane (d) 5-ethyl-4, 4-dimethyloctane

32. In Diels-Alder reaction which of the following will react most slowly with tetracyanoethene.

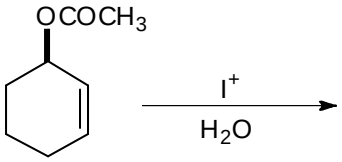
(a) 

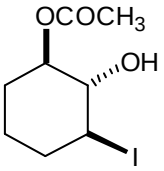
(b) 

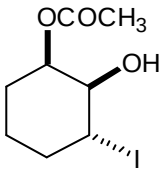
(c) 

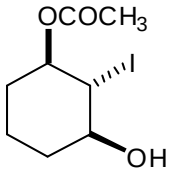
(d) 

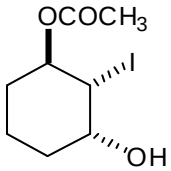
33. In the following reaction which will be the preferred product?



(a) 

(b) 

(c) 

(d) 

34. The general molecular formula of sesquiterpenoids is

(a) $C_{10}H_{16}$ (b) $C_{10}H_{22}$ (c) $C_{15}H_{24}$ (d) $C_{15}H_{32}$

35. Which of the following is not true?

(a) sun rays contain vitamin D

(b) sun's ultraviolet rays assist in the synthesis of vitamin D from a precursor present in our skin

(c) vitamin D deficiency could develop brittle bones

(d) vitamin D can be ingested through diet or supplements

36. Pick out the incorrect match?

(a) Sanger reagent	1-fluoro-2, 4-dinitrobenzene
(b) Edman reagent	phenyl isothiocyanate
(c) Strecker amino acid synthesis	i. aldehyde + HCN; ii. hydrolysis
(d) Merrifield peptide synthesis	polystyrene resin

37. Which of the following structures will not have detergent properties?

(a) $CH_3(CH_2)_{11}CH_2\overset{\overset{O}{\|}}{C}-OCH_3$

(b) $CH_3(CH_2)_{11}CH_2CH_2O$-glucose

(c) $CH_3(CH_2)_{11}CH_2CH_2OSO_3H$

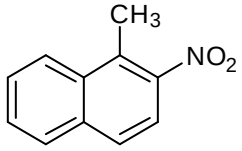
(d) $CH_3(CH_2)_{11}CH_2CH_2\overset{+}{N}(CH_3)_3\ Cl^-$

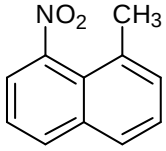
38. Aspirin is

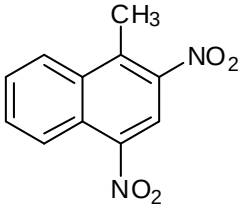
(a) salicylic acid (b) 2-acetoxybenzoic acid

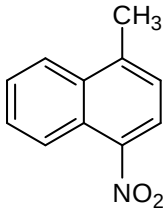
(c) methyl salicylate (d) 2-acetoxy benzaldeyde

39. The major organic product of aromatic nitration of 1-methyl naphthalene is

(a) 

(b) 

(c) 

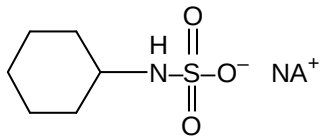
(d) 

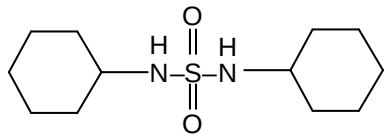
40. Which of the following aldehydes can undergo self condensation?

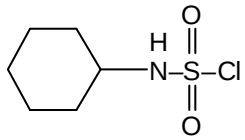
(a) PhCHO (b) HCHO

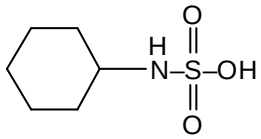
(c) $(CH_3)_3CCHO$ (d) $(CH_3CH_2)_2CHCHO$

41. Cyclamate, an artificial sweetner can be prepared by the reaction of cyclohexylamine and chlorosulfonic acid, followed by the treatment with sodium hydroxide. Which is the structure of this cyclamate?

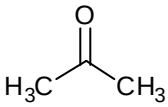
(a) 

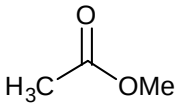
(b) 

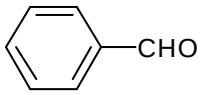
(c) 

(d) 

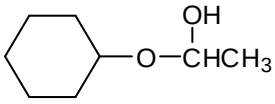
42. Which one of the following is un-reactive to $NaBH_4$ reduction?

(a) CH_3-CHO (b) 

(c) 

(d) 

43. The functional group in the following compound is



(a) hemiacetal (b) hemiketal (c) acetal (d) ketal

44. The octane rating of gasoline refers to its

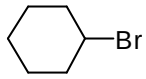
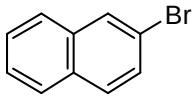
(a) percentage C_8H_{18} in gasoline (b) radiation dose

(c) percentage of unsaturated hydrocarbons (d) ability to resist engine knocking

45. The compound $CFCl_3$ is used as a/an
(a) enzyme (b) anesthetic
(c) gaseous fuel (d) refrigerant

46. An increase in the amount of particulate matter (dust and smoke) in the atmosphere may result in cooler world temperature because
(a) more sunlight is absorbed by Earth
(b) more IR is emitted into space
(c) the dust reflects solar radiation
(d) dust reacts with ozone in an exothermic reaction

47. Polacrylonitrile, characterized by the repeating units made from which of the following monomers?
(a) CH_3CH_2CN (b) $HOCH_2CH_2CH_3$
(c) $CH_3CH = CHCN$ (d) $CH_2 = CHCN$

48. Which of the following compounds could not be used to prepare a Grignard reagent?
(a)  (b) 
(c) $HOCH_2CH_2CH_2Br$ (d) $CH_3C{\equiv}CCH_2CH_2I$

49. Identify the correct order for placing the following compounds in increasing oxidation state.
CH_3CH_2OH, CH_3COOH, CO_2, $CH_2=CH_2$
(a) $CH_2=CH_2 < CH_3CH_2OH < CH_3COOH < CO_2$
(b) $CH_2=CH_2 = CH_3CH_2OH < CH_3COOH < CO_2$
(c) $CH_3CH_2OH < CH_2=CH_2 < CH_3COOH < CO_2$
(d) $CH_2=CH_2 < CH_3CH_2OH < CO_2 < CH_3COOH$

50. Which of the following alkenes will react most readily with HBr?
$CH_3CH_2CH=CH_2$ $CH_2=CH_2$ $(CH_3)_2C=CHCH_3$
(a) $(CH_3)_2C=CHCH_3$ (b) $CH_2=CH_2$
(c) $CH_3CH_2CH=CH_2$ (d) no difference in reactivity

51. In Williamson synthesis, ethers are produced by reacting an
(a) alcohol with a metal (b) an alkyl halide with alkoxide
(c) alkoxide with a metal (d) an aldehyde with alkyl halide

52. Which reaction produces ethyl alcohol as one of the principal products?
(a) an esterification reaction (b) a neutralization reaction
(c) a dehydration reaction (d) a fermentation reaction

53. The maximum number of hydrogen bonds that a molecule of water can have is
(a) 1 (b) 2 (c) 3 (d) 4

54. The major product of dehydration of neopentyl alcohol is
(a) $(CH_3)_2C = CHCH_3$ (b) $(CH_3)_3C–CHO$
(c) $H_2C=CHCH(CH_3)_2$ (d) None of the above

55. Arrange the following compounds in order of increasing intensity of infrared absorption by the double bond (least intense first) assuming the same concentration and other conditions.

(I) $H_3C-\overset{\overset{O}{\|}}{C}-CH_2CH_3$ (II) $(CH_3)_2C=C(CH_3)_2$ (III) $CH_3CH_2CH=CH_2$

(a) I < II < III (b) II < III < I

(c) III < II < I (d) II < I < III

56. List the following compounds in order of decreasing acidity

(I) $\underset{F}{CH_2}CH_2OH$ (II) CH_3CH_2OH (III) $CH_3\underset{F}{CH}OH$ (IV) $\underset{Cl}{CH_2}CH_2OH$

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

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

57. A protein that has been reversibly denaturated has

(a) temporarily lost part or all of its secondary or tertiary structure

(b) temporarily lost part or all of its primary structure

(c) temporarily lost its amino acid residues

(d) temporarily lost the hydrogen bonding between nitrogenous bases

58. How many moles of BH_3 are needed to react with 2 moles of 1-pentene?

(a) 2 moles (b) 1 mole (c) 2/3 mole (d) 3/2 moles

59. (+) Mandelic acid has a specific rotation of +158º. What would be the observed specific rotation of 25% (-)-mandelic acid and 75% (+)-mandelic acid?

(a) +79º (b) 0 (c) –79º (d) +39.5º

60. How many peaks will be observed in the 1H NMR spectrum of 1-chloro-4-methoxy-benzene?

(a) 2 (b) 3 (c) 5 (d) 1

61. In a tetragonal crystal

(a) $a = b = c, \alpha = \beta = 90^o \neq \gamma$ (b) $a = b \neq c, \alpha = \beta = \gamma = 90^o$

(c) $a \neq b \neq c, \alpha = \beta = \gamma = 90^o$ (d) $a = b \neq c, \alpha = \beta = 120^o, \gamma = 90^o$

62. Increasing the temperature of an aqueous solution causes

(a) decrease in molality (b) decrease in molarity

(c) decrease in mole fraction (d) increase in molarity

63. The depression in freezing point for 1M Urea, 1M glucose and 1M NaCl are in the ratio

(a) 3 : 2 : 2 (b) 1 : 2 : 3 (c) 1 : 1 : 2 (d) None of these

64. The van't Hoff factor *i* for a compound which undergoes dissociation in one solvent and association in other solvent is respectively

(a) > 1 and > 1 (b) < 1 and > 1 (c) < 1 and < 1 (d) > 1 and < 1

65. What will happen if we place Red blood corpuscles (RBC) in (i) 1% (mass/volume) NaCl solution and in (ii) 0.5% (Mass/volume) NaCl solution

(a) It will shrink in (i) and swell in (ii) (b) It will swell in (i) and shrink in (ii)

(c) It will swell in both (i) and (ii) (d) It will shrink in both (i) and (ii)

66. The boiling point of carbon tetrachloride is 77ºC and the heat of vaporization is 31 kJ mol^{-1}. The vapour pressure of Carbon tetrachloride at 25ºC will be

(a) ~ 0.156 atm (b) ~ 1.21 atm (c) ~ 0.011 atm (d) ~ 2.1 atm

67. The osmotic pressure of a 0.1M monobasic acid having a pH of 2 at 25ºC is
(a) ~ 5.38 atm (b) ~ 1.34 atm (c) ~ 0.882 atm (d) ~ 2.69 atm

68. The mole fraction of a gas dissolved in a solvent is given by Henry's law. If the Henry's constant for a gas in water at 298K is 5.55×10^7 torr and the partial pressure of the gas is 200 torr. What is the amount of gas dissolved in 1.0 kg of water.
(a) ~ 3.6×10^{-7} mol (b) ~ 2.5×10^{-5} mol
(c) ~ 2.0×10^{-4} mol (d) ~ 1.2×10^{-3} mol

69. The standard electrode potential of three metals X, Y and Z are –1.3V, 0.6V and –3.0V respectively. The reducing power of these metals follow the order
(a) X > Y > Z (b) Y > Z > X
(c) Y > X > Z (d) Z > X > Y

70. The emf of the given cell $Pt|H_2(P_1)|H^+(aq)|H_2(P_2)|Pt$ is given by
(a) $(RT/F)\ln(P_1/P_2)$ (b) $(RT/2F)\ln(P_1/P_2)$
(c) $(RT/F)\ln(P_2/P_1)$ (d) None of these

71. Acetaldehyde (CH_3CHO) decomposes by second order kinetics with a rate constant of 0.334 M^{-1} s^{-1} at 500ºC. The time it would take for 80% of the acetaldehyde to decompose in a sample that has an initial concentration of 0.00750 M is
(a) ~ 1600 sec (b) ~ 1850 sec (c) ~ 1000 sec (d) ~ 5100 sec

72. For a van der Waals gas, the inversion temperature is given by
(a) $T_i = 2aR/b$ (b) $T_i = a/2Rb$ (c) $T_i = ab/2R$ (d) $T_i = 2a/Rb$

73. Heat capacity of a diatomic gas in the low temperature range
(a) is independent of its temperature
(b) decreases with increase in temperature
(c) increases with increase in temperature
(d) increases followed by a decrease with increase in temperature

74. The ionic strength of a solution which is 0.1 m in KCl and 0.2 m in K_2SO_4 is
(a) 0.96 m (b) 0.70 m (c) 0.011 m (d) 1.12 m

75. Which of the following facts regarding the viscosity of a gas is correct
(a) Viscosity of gas is due to intermolecular interaction
(b) Viscosity of gas is independent of pressure
(c) Viscosity of gas decreases with increase in temperature
(d) Viscosity of a gas is independent of molecular mass

76. Pure water has $[H_3O^+] = 10^{-6}$ moles L^{-1} at 90ºC, the value of K_w at this temperature will be
(a) 10^{-8} M^2 (b) 10^{-12} M^2 (c) 10^{-14} M^2 (d) 10^{-6} M^2

77. If we titrate NH_4OH against HCl at 25ºC, the pH of the solution at equivalence point will be
(a) ~ 5.5 (b) ~ 1.5 (c) ~ 8.5 (d) ~ 9.5

78. Which of the following ions is the most effective in the coagulation of an Arsenic sulphide sol
(a) Ca^{2+} (b) K^+ (c) Al^{3+} (d) Cl^-

79. For a diatomic gas at high temperature the value of the ratio of $C_{p,m}$ and $C_{v,m}$ is
(a) 7/5 (b) 2/3 (c) 9/7 (d) 9/11

80. The rate of diffusion of methane at a given temperature is twice that of a gas 'P'. The molecular weight of P is
(a) 64 (b) 36 (c) 40 (d) 16

81. The angular momentum of an electron in 4*f* orbital is

(a) $(24)^{3/2}(h/2\pi)$ (b) $(12)^{1/2}(h/2\pi)$ (c) $(6)^{1/2}(h/2\pi)$ (d) $(2)^{1/2}(h/2\pi)$

82. In an atomic orbital the sign of lobes indicate

(a) sign of charge
(b) sign of the probability distribution
(c) sign of the wave function
(d) presence and absence of electrons

83. The energy of the electron in the first Bohr orbit for hydrogen is –13.6 eV. Which one of the following is the possible energy of the excited state for electron in Bohr orbits of hydrogen atom?

(a) –3.4 eV (b) –6.8 eV (c) +1.9 eV (d) 13.6 eV

84. A particle of mass 2.0×10^{-26} g is in a one dimensional box of length 4.0 nm. The wavelength of the photon emitted when this particles goes from $n = 3$ to $n = 2$ level is

(a) 1.11×10^{-5} m
(b) 3×10^{-10} m
(c) 8.96×10^{-6} m
(d) 2.32×10^{-4} m

85. An electrochemical cell can behave like an electrolyte cell when

(a) $E_{cell} = 0$ (b) $E_{cell} > E_{ext}$ (c) $E_{ext} > E_{cell}$ (d) $E_{cell} = E_{ext}$

(E_{ext}: external emf)

86. Which of the following expressions is not correct (the symbols have their usual meanings)

(a) $A = \log(I_0 / I)$
(b) $\mu = m_1 m_2 / ((m_1 + m_2)$
(c) $\bar{\upsilon} = (1/2\pi c)(\mu / K)^{1/2}$
(d) $E_v = (v + \frac{1}{2})hv$

87. Which of the following expression about logarithm is incorrect

(a) $\log(2)^{2n} = n \log 4$
(b) $\log(m+n) = \log m + \log n$
(c) $\log(m/n) = \log m - \log n$
(d) $\log 1000 = 3$

88. Which of the following is not true for X-rays

(a) These radiation can ionize gases
(b) It causes ZnS to fluoresce
(c) These are deflected by electric and magnetic fields
(d) Have wavelength shorter than ultraviolet radiations

89. Which of the following statement is not correct for the order of a reaction

(a) The order of a reaction is the sum of coefficients of the reactants in the balanced chemical equation
(b) The order of a reaction is an experimentally determined quantity
(c) The order of a reaction can be fractional
(d) The order of a reaction can be zero

90. Which of the following represent the wave number of radiation lying in the visible region

(a) 2×10^4 cm^{-1}
(b) 1×10^7 cm^{-1}
(c) 4×10^9 cm^{-1}
(d) 4×10^{12} cm^{-1}