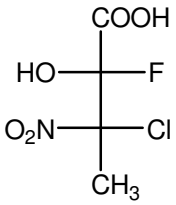
MSc(HS/2Yr)(Chemistry)

1. **Which of the following is most stable carbocation?**
   (A) $(C_6H_5)_3C^+$ (B) $C_6H_5CH_2^+$ (C) $(CH_3)_2CH^+$ (D) $CH_3CH_2^+$

2. **Assign *R* or/and *S* designation to the following molecule**



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

3. **The order of reactivity of halogen for the halogenations of alkanes follows the sequence**
   (A) $Cl_2 > F_2 > Br_2 > I_2$ (B) $Br_2 > F_2 > I_2 > Cl_2$
   (C) $I_2 > Br_2 > Cl_2 > F$ (D) $F_2 > Cl_2 > Br_2 > I_2$

4. **When propene is treated with chlorine at 773 K, reaction results in the formation of**
   (A) 1-Chloropropene (B) 2-Chloropropene
   (C) 3-Chloropropene (D) 1,2-Dichloropropene

5. **Reduction of vinyl acetylene with H_2 in presence of lindlar's catalyst produces**
   (A) Buta-1,3-diene (B) Penta-1,4-diene
   (C) Penta-1,3-diene (D) Buta-1,2-diene

6. **Treatment of benzene with ethyl bromide with anhydrous$AlBr_3$ gives**
   (A) Bromo benzene (B) Ethyl benzene
   (C) Toluene (D) 1-Phenyl-2 bromoethane

7. **SN_2 reactions in alkyl halidesfollow**
   (A) Second order kinetics (B) First order kinetics
   (C) Third order kinetics (D) Zero order kinetics

8. **Name the reaction which leads to following conversion**

$$R_2C{=}O + (CH_3)_2CHOH \xrightarrow{[(CH_3)_2CHO]_3Al} R_2CHOH + CH_3COCH_3$$

   (A) Birch reduction (B) Bouveault- Blanc reduction
   (C) Wolf-Kishner reduction (D) Meerwein-Poundroff-Verley reduction

9. **Hydrolysis of cumene hydroperoxide with dil. H_2SO_4gives**
   (A)Aniline and acetaldehyde (B) Phenol and acetone
   (C) Toluene and hydrogen peroxide (D) Anisole and benzene

10. Conversion of benzaldehyde to cinnamic acid using acetic anhydride in the presence of base can be termed as

(A) Aldol condensation (B) Benzoin condensation
(C) Perkin condensation (D) Knoevenagal condensation

11. $CH_3CH_2CONH_2$ can be transformed to $CH_3CH_2NH_2$ using reagent

(A) Br_2/ KOH (B) Br_2/P (C) Br_2/CCl_4 (D) PBr_3

12. 2-Bromo propionic acid reacts with alc. KOH and followed by hydrolysis to produce

(A) 2-Hydoxy propionic acid (B) Acrylic acid
(C) Bromoacetyl bromide (D) Acetic acid

13. How many NMR signals are expected in the NMR spectrum of *n*-propyl bromide?

(A) Four (B) Three (C)Two (D) Five

14. The C=O stretching absorption band in the infra-red spectra of acetophenone appears at

(A) 2200 cm^{-1} (B) 2860 cm^{-1} (C) 3100 cm^{-1} (D) 1705 cm^{-1}

15. Which of the following is cationic detergent?

(A) Cetyl trimethyl ammonium chloride (B) Sodium laury sulphate
(C) Polyethylene glycol (D) Lauryl alcohol ethoxylate

16. Oxidation of naphthalene with CrO_3/CH_3COOH at 298K affords

(A) Phthalic anhydride (B) Phthalic acid
(C) 1,4-Naphthaquinone (D) 1,4-Dihydronaphthalene

17. Glucose reacts with the following reagent to form the osazone

(A) HCN (B) $C_6H_5NHNH_2$ (C) HNO_3 (D) $(CH_3CO)_2O$

18. The transfer of excess energy from one molecule to another in environment all at once is called as

(A) Photo dissociation (B) Photo sensitisation
(C) Photo reduction (D) Photo isomerisation

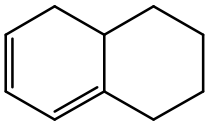
19. Shifting of the absorption maximum towards shorter wavelength in Ultra-Violet (UV) spectroscopy is known as

(A) Hypsochromic shift (B) Hypochromic shift
(C) Bathochromic shift (D) Hyperchromic shift

20. Pyrrole under catalytic reduction with Pd produces

(A) 2-Phenyl azopyrrole (B) Piperidine
(C) Pyrrolidine (D) Quinoline

21. Using Woodward–Fieser rules the λ_{max} for the following compound is



(A) 313 nm (B) 273nm (C) 253nm (D) 242nm

22. Degradation of alkaloids can be done by following method

(A) Zerewitnoff method (B) Kohn-Roth oxidation method
(C) Friedlander's method (D) Emde's method

23. When iodoform is heated with silver powder the product formed is

(A) Ethane (B) Ethene (C) Ethyne (D) Ethanol

24. Ethyl chloroformate on treatment with CH_3MgBr form an addition product which is unstable and gives

(A) CH_3CH_2OH (B) $CH_3COOC_2H_5$ (C) $ClCH_2COOH$ (D) CH_3COCl

25. For N-terminal residue analysis using Sanger's method, the peptide is initially treated with

(A) C_6H_5COCl (B) $C_6H_5N=C=S$ (C) $(NO_2)_2C_6H_3F$ (D) NH_2NH_2

26. For which one of the following ions, the colour is not due to d-d transitions:

(A) CrO_4^{2-} (B) $Cu(NH_3)_4^{2+}$ (C) $Ti(H_2O)_6^{3+}$ (D) CoF_6^{3-}

27. CO_2 has

(A) 3 vibrational modes (B) 4 vibrational modes, 2 of which are degenerate
(C) Stretching modes only (D) An IR active symmetric stretch

28. Which of the following molecules and ions have S_4 axis?

(A) SO_4^{2-} (B) BF_3 (C) C_2H_2 (D) CO_2

29. Crown ether and cryptate –

(A) Both have N and O donor atoms
(B) Both are polycyclic
(C) Have O and N donor atoms respectively
(D) Cryptate is a weaker complexing agent than crown ether

30. Which of the followings are isoelectronic and isostructural?

NO_3^-, CO_3^{2-}, ClO_3^-, SO_3

(A) NO_3^-, CO_3^{2-} (B) NO_3^-, SO_3 (C) CO_3^{2-}, ClO_3^- (D) CO_3^{2-}, SO_3

31. In a non-polar AX_2, the bond moment of AX is 0.56 D. The bond angle is

(A) 30° (B) 45° (C) 90° (D) 180°

32. Which one of these orders of acidic strength of hydrated cations is false?

(A) $[Fe(H_2O)_6]^{3+} > [Al(H_2O)_6]^{3+}$ (B) $[V(H_2O)_6]^{3+} > [La(H_2O)_6]^{3+}$
(C) $[Ba(H_2O)_n]^{2+} > [Be(H_2O)_n]^{2+}$ (D) $[Cu(H_2O)_n]^{2+} > [Ca(H_2O)_n]^{2+}$

33. The highest magnetic moment will be shown by
(A) Sc (B) Fe (C) Co (D) Ni

34. The orange colour of $Cr_2O_7^{2-}$ is due to
(A) Metal to ligand charge transfer transition
(B) Ligand to metal charge transfer transition
(C) Crystal field transition
(D) Charge transfer complex formation

35. Which one of the following has tetrahedral geometry:
(A) $[Co(NH_3)_6]^{3+}$ (B) $[Ni(CN)_4]^{2-}$ (C) $[Fe(CO)_6]$ (D) $[NiCl_4]^{2-}$

36. Which of the following does not obey EAN rule ?
(A) $[Cu(CN)_4]^{3-}$ (B) $[Pt(NH_3)_4]^{2+}$ (C) $[Pd(NH_3)_6]^{4+}$ (D) $[Cr(CO)_6]$

37. In a solid "AB" having NaCl structure "A" atoms occupy the corners of the cubic unit cell. If all the face-centred atoms along one of the axes are removed, then the resultant stoichiometry of the solid is
(A) AB_2 (B) A_2B (C) A_4B_3 (D) A_3B_4

38. The van der Waal's forces in halogen decreases in the order:
(A) $F_2 > Cl_2 > Br_2 > I_2$ (B) $I_2 > Br_2 > Cl_2 > F_2$
(C) $Br_2 > Cl_2 > F_2 > I_2$ (D) $Cl_2 > Br_2 > I_2 > F_2$

39. Dinitrogen tetroxide , N_2O_4, is a mixed anhydride because it:
(A) Is a mixture of N_2O_3 and N_2O_5
(B) Decomposes into two oxides of nitrogen
(C) React with water to form nitric acid
(D) React with water to form two acids

40. A magnetic moment of 1.73 B.M. will be shown by one among the following compounds:
(A) $[Ni(CN)_4]^{2-}$ (B) $[TiCl_4]$ (C) $[CoCl_6]^{4-}$ (D) $[Cu(NH_3)_4]^{2+}$

41. Alumina on heating with carbon in nitrogen atmosphere gives:
(A) Al + CO (B) Al + CO_2 (C) AlN + CO (D) Al + CO + N_2

42. P_4O_{10} has short and long P-O bonds. The number of short P-O bonds in this compound is:
(A) 1 (B) 2 (C) 3 (D) 4

43. CO_2 and N_2 are non- supporter of combustion. However, for putting out fires CO_2 is preferred over N_2 and CO_2:

(A) Does not burn
(B) Forms non-combustible products with burning substances
(C) Is denser than nitrogen
(D) Is a more reactive

44. Newly shaped glass articles when cooled suddenly become brittle, therefore these are cooled slowly, this process is known as:
(A) Tempering (B) Annealing (C) Quenching (D) Galvanising

45. Al_2O_3 formation involves large quantity of heat evolution which makes its use in:
(A) Deoxidiser (B) Confectionary
(C) Indoor photography (D) Thermite welding

46. Optical isomerism is shown by
(A) $[Ni(CO)_4]$ (B) $[Ni(CN)_4]^{2-}$ (C) $[Pt(NH_3)_4]^{2+}$ (D) $[Co(en)_3]^{3+}$

47. BrO_3^- is isostructural with a noble gas species
(A) XeO_3 (B) XeF_3 (C) XeF_4 (D) XeO_2

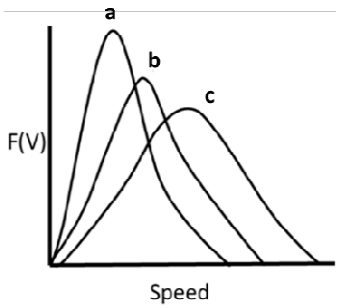
48. Which of the following is non-linear according to VSEPR theory?
(A) CO_2 (B) $[N_3]^-$ (C) $[I_3]^-$ (D) $[ClF_2]^+$

49. The styx code for diborane is
(A) 2020 (B) 2200 (C) 2002 (D) 0220

50. d-p mixing occurs in
(A) Tetrahedral complexes only (B) Octahedral complexes only
(C) Complexes with no centre of symmetry (D) Complexes with centre of symmetry

51. For any operator A and its adjoint $A^\dagger$, the incorrect statement is:
(A) $A\,A^\dagger$ is Hermitian (B) $A\,A^\dagger + A\,A^\dagger$ is hermitian
(C) $A+A^\dagger$ is hermitian (D) $A - A^\dagger$ is Hermitian

52.



At constant temperature, identify the correct match of speed distribution functions *w.r.t* Ne, Ar, and Kr with the curves in the figure above
(A) Ne-a, Ar-b, Kr-c (B) Ne-b, Ar-c, Kr-a
(C) Ne-c, Ar-b, Kr-a (D) Ne-c, Ar-a, Kr-b

53. Calculate the reduction potential of a half-cell consisting of platinum electrode immersed in 2.0 M Fe^{2+} and 0.02 M Fe^{3+}.
Given $E^o_{Fe^{3+}/Fe^{2+}}$ = 0.771 V
(A) 0.798 V (B) 0.889 V (C) 2.771 V (D) 0.652 V

54. Which of the following is not linear operators?
$\frac{d^2}{dx^2}\frac{d}{dx}$, √, x^2
(A) $\frac{d^2}{dx^2}$ (B) x^2 (C) √ (D)$\frac{d}{dx}$

55. The number of carbon atoms per unit cell of diamond unit cell is:
(A) 8 (B) 6 (C) 1 (D) 4

56. At 25°C the molar conductances at infinite dilution of CH_3COONa, HCl and NaCl are 91.0 x 10^{-4}, 426.16 x 10^{-4} and 126.45 x 10^{-4} S m^2 mol^{-1}, respectively. The Λ^o_m for CH_3COOH is
(A) 109.11 x 10^{-4} S m^2 mol^{-1} (B) 286.45 x 10^{-4} S m^2 mol^{-1}
(C) 191.74 x 10^{-4} S m^2 mol^{-1} (D) 390.71 x 10^{-4} S m^2 mol^{-1}

57. Match the type of colloidal systems given in column I and column II

Column – I	Column – II
(i) Solid in liquid	(a) Foam
(ii) Liquid in solid	(b) Sol
(iii) Liquid in liquid	(c) Gel
(iv) Gas in liquid	(d) Emulsion

(A)(i)-(b), (ii)-(c), (iii)-(d), (iv)-(a) (B) (i) -(c), (ii)- (b), (iii)-(a), (iv) -(d)
(C)(i)-(b), (ii)- (c), (iii)- (a), (iv) -(d) (D) (i)- (c), (ii)- (b), (iii)- (d), (iv)- (a)

58. Potential of hydrogen electrode at pH = 10 is :
(A) +0.59 V (B) 0.00 V (C) -0.59 V (D) -0.059 V

59. For an ideal solution which combination is correct (where ΔV_{mix} is volume change on mixing and ΔH_{mix} is enthalpy change on mixing)
(A) $\Delta V_{mix} > 0$, $\Delta H_{mix} > 0$ (B) $\Delta V_{mix} < 0$, $\Delta H_{mix} < 0$
(C) $\Delta V_{mix} = 0$, $\Delta H_{mix} = 0$ (D) $\Delta V_{mix} > 0$, $\Delta H_{mix} < 0$

60. Rust is a mixture of:
(A) FeO and $Fe(OH)_2$ (B) FeO and $Fe(OH)_3$
(C) Fe_3O_4 and $Fe(OH)_3$ (D)Fe_2O_3 and $Fe(OH)_3$

61. The heat capacity of 10 mol of an ideal gas at a certain temperature is 300 JK^{-1} at constant pressure. The heat capacity of the same gas at the same temperature and at constant volume would be (in JK^{-1})

(A) 299.10 (B) 46.63 (C) 216.86 (D) 0

62. The van der Waal's equation reduces itself to the ideal gas equation at:

(A) High pressure and low temperature
(B) Low pressure and high temperature
(C) Low pressure and low temperature
(D) Critical pressure and critical temperature

63. The Stark-Einstein law of photochemical equilibrium is defined as:

(A) $\Delta E = \frac{Nhc}{\lambda}$ (B) $\frac{N}{\lambda hc} = \Delta E$ (C) $\frac{\lambda}{hc} = \Delta E$ (D) $\frac{\Delta E}{\lambda} = Nhc$

64. A first order reaction takes 40 min for 30% decomposition.
Calculate $t_{1/2}$ (Given log 3 = 0.477, log 5 = 0.699 , log 7 = 0.845)

(A) 77.7 (B) 8.9 (C) 133.7 (D) 80.5

65. For the reaction at 527 ^{o}C

N_2 (g) + 3 H_2 (g) $\rightleftharpoons$ 2NH_3 (g)
The ratio of K_P and K_C is (R = 0.082 L atm mol^{-1} K^{-1})

(A) 3.23 x 10^{-6} (B) 2.32 x 10^{-4} (C) 2.32 x 10^{4} (D) 3.23 x 10^{6}

66. P.Q.R branches of spectral lines are observed in

(A) Vibrational spectrum of diatomic molecule
(B) Rotational spectrum of diatomic molecule
(C) Vibrational rotational spectrum of diatomic molecule
(D) Raman spectrum of diatomic molecule

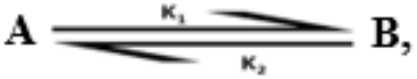
67. What is the log $\gamma_{\pm}$ value of aqueous solution of Na_2SO_4 of 0.001 molality at 25^{0}C? where $\gamma_{\pm}$ is mean ionic activity coefficient and for water at 25^{0}C, the value of Debye-Huckel constant is 0.509.

(A) 0.879 (B) -0.055 (C) - 0.003 (D) -0.905

68. The relation of free energy change with temperature and pressure is

(A) dG = VdP (B) dG = SdT (C) dG = VdP - SdT (D) dG = VdP + SdT

69. For a reversible reaction



Ist order in both the directions, the rate of reaction is given by:

(A) $K_1[A]$ (B) $-K_2[B]$ (C) $K_1[A]+ K_2[B]$ (D) $K_1[A]-K_2[B]$

70. The expression for Hamiltonian operator is

(A) $-\frac{h^2}{8m\pi^2}\nabla^2 + v$ (B) $\frac{h^2}{8m\pi^2}\nabla^2 + v$ (C) $-\frac{h^2}{8m\pi^2}\nabla^2 - v$ (D) $-\frac{h^2}{8m\pi^2}\nabla^2 - v^2$

71. The pH of a 0.005 molar aqueous solution of sulphuric acid is approximately

(A) 0.005 (B) 1 (C) 2 (D) 0.1

72. The rate constant, the activation energy and the Arrhenius parameter of a chemical reaction at 25°C are $3.0 \times 10^{-4}\ s^{-1}$, 104.4 KJ mol^{-1} and $6.0 \times 10^{14} s^{-1}$, respectively. The value of rate constant as $T \rightarrow \infty$ is;

(A) $6.0 \times 10^{14} s^{-1}$ (B) 3.6×10^{30} (C) Zero (D) infinite

73. Freundlich isotherms is not applicable at

(A) Low pressure (B) Room temperature
(C) High pressure (D) 273 K

74. What will be the equilibrium constant at 717 K for the reaction:

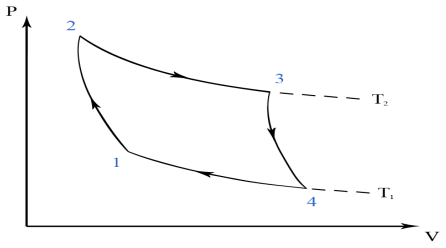
$$HI\ (g) \rightleftharpoons \frac{1}{2} H_2\ (g) + \frac{1}{2} I_2\ (g)$$

If its value for the reaction

$$H_2\ (g) + I_2\ (g) \rightleftharpoons 2HI\ (g)$$ **at 717 K is 64 ?**

(A) 64 (B) 8 (C) 1/64 (D) 1/8

75. The figure below describes a carnot engine work. Which path show adiabatic expansion.



(A) 3 to 4 (B) 2 to 3 (C) 1 to 2 (D) 4 to 1

x-x-x