DEPARTMENT OF CHEMISTRY

QUESTION BANK
+3 1st Year Science
Semester - I

Inorganic Chemistry — Core - I

Group- A

Each question carries 1 mark. (Fill in the blanks)

1. When n=3, the shell is called_____.

2. L- shell contains maximum _____ no. of electrons.

3. When an electron jump from lower orbit E_1 to higher orbit E_2, the energy is absorbed_____.

4. Orbits are allowed for circular motion of electron, the angular momentum = _____.

5. Energy of an electron for n^{th} orbit is _____.

6. Radius of an electron for n^{th} orbit is _____.

7. _____ is the spectral series when n1=2 and n2= 3,4,5……

8. Shape of S orbital is _____.

9. The value of Rydberg's constant R_H is _____.

10. In De-Broglie equation, the relation of λ is equal to _____.

11. De-Broglie equation has significance for_____ particle.

12. In uncertainty principle, - X – h/ λπ.

13. Uncertainty principle in applicable for_____ particle.

14. Schrodinger wave equation is applicable for _____ system.

15. For Normalised wave function,

16. For orthogonal wave function,

17. For 3d - sub shell, the n + l value is _____.

18. In 2P – sub shell, the value of n= _____ and l= _____.

19. _____ quantum represent the shape of sub shell or orbital.

20. d- sub shell confirm _____ no. of electron maximum.

21. Long form of periodic table is consisting of _____ no. of period.

22. Long form of periodic table is consisting of _____ no. of groups.

23. 6^{th} period contain _____ no. of elements.

24. _____ period is incomplete.

25. 2,8,8,18,18 and 32 is called _____ number.

26. halogen placed in _____ group in the periodic table.

27. Group- IA elements are called _____ elements.

28. Group- IB elements are called _____ elements.

29. Be, Mg, Cu…… are placed _____ group in the periodic table.

30. d- block elements are called _____.

31. The general E.C of D- block elements is _____.

32. The E.A of noble gas elements is _____.

33. I.E of the elements are _____ along a period.

34. I.E of the elements are _____ along a group.

35. _____elements have maximum E.A value.

36. The size of Na is _____ than Na^+.

37. The size of F is _____ than Cl.

38. The size of Cl is _____ than Cl.

39. The E.A of Cl is _____ than F.

40. E.A values of the elements are _____ along a period.

41. The N_2 is _____in magnetic character.

42. The O_2 is _____ in magnetic character.

43. N_2 is _____ stable than O_2.

44. The molecule contain 3bp and 1lb, the shape is _____.

45. The Born-londe equation is _____.

46. Born-Haber cycle in used for determination of _____.

47. For stable ionic compound, the I.E. is _____ and E.A is _____.

48. In NH_3, the N has _____ no. of ion pair of element.

49. O_2 is _____ stable than O_2+.

50. Bond order of He_2 is _____.

Group- B

Each question carries 1.5 marks.

1. Give the energy relation of nth orbit of an atom.
2. Define Pauli's Exclusion Principle.

3. What is the value of n, l, m and s of 4s' electron.

4. Define screening constant.

5. What is the Shielding constant and effecting nuclear charge on 4s electron of Ca?

6. Give Kapustinskii expression for calculation of lattice energy with one importance.

7. Define Bent's Rule.

8. Why is HF less volatile than HCl?

9. Give the stability order of N_2, N_2^- & N_2^+.

10. Why is NH_3 liquid while pH_3 gas?

11. What is bond order? How does it relate to the stability of molecule?

12. Define and give the expression of dipole moment.

13. Why is the difference observed between the <FOF angle (103^0) and <ClOCl angle (111^0) in F_2O and Cl_2O respectively?

14. Which has higher energy : 2s orbital of H or 2s orbital of He^+?

15. What is the difference between conductor and semiconductor?

16. PCl_5 exists while NCl_5 does not. Give reason.

17. What do you understand by anti-bonding concept of MOT?

18. Write the molecular electronic configuration of He_2^+ molecule.

19. Why is the vanderWaal's radii greater than the covalent radii of chlorine?

20. Which has higher ionisation energy between S and P?

21. Give examples of a molecule with sp^3d hybridisation.

22. Why is not HNO_3 a reducing agent?

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44. Why is not HNO_3 a reducing agent?

45. Find out the bond order of C_2.

46. Define dipole –dipole interaction.

47. What is volumetric analysis?

48. What is standard electrode potential?

49. What is shape and hybridization of NH_3 / NH_4^+?

50. What is the Sederson's electron density ratio?

Group- C

Each question carries 2.5 marks.

1. Write four limitations of Bohr's atomic theory.

2. What do you understand by $2p^5$ and $2p^1_x$?

3. Find the m value for p, d and f orbital?

4. Give four characteristics of d_z^2 orbital?

5. How do dx^2y^2 orbital differ from d_{xy} orbital?

6. Derive the formula for 2th orbit of Bohr's atom.

7. Calculate energy of electron of nth orbit of H atom.

8. Calculate the frequency of radiation formula from energy calculation.

9. Calculate the energy of electron in the third orbit He^+ cation.

10. Calculate the frequency of first line in Balmer series. R = 109677.8 cm^{-1}.

11. What is Zeeman and stark effect?

12. Derive De-Broglie equation for matter wave.

13. Using Heisenberg Uncertainty principle. Show that an electron cannot exist in nucleus.

14. The mass of an electron is 9.11 x 10^{-31}Kg. Calculate the uncertainty in its velocity.

15. How many electrons in the ground state a Zn atom (Z=30) has

    (a) Angular momentum l = 1

    (b) Magnetic quantum number m = 1

16. Write Schrodinger wave equation and also write the significance of Ψ and Ψ^2.

17. What do you understand by Radical and Angular wave function?

18. Using Schrodinger equation $\Delta^2\Psi + 8\pi^2 m/h^2 (E-V) \Psi = 0$. Derive the energy of an electron in H atom.

19. Write the condition for normalized and orthogonal wave function.

20. Draw radical wave function for 1s orbital and 2s orbital of H atom.

21. Find the frequency of first line of Lyman series.

22. Find the wave number of third line in Pfund series.

23.Calculate energy of hydrogen atom in first excited state.The value of e = 4.8×10^{-10}esu, mass of electron = 9.1×10^{-28}g.

24. Differentiate between particle and wave.

25. State Slater's rule.

26. Why the cation been smaller size than the parent atom? Explain using Slater's rule?

27. Calculate the Z* (Effective nuclear charge) of Δl^+ ion.

28. What are the limitation of Slater's rule?

29. Write general electronic configuration of d and f block elements.

30. Write 5 general characteristics of p- block element.

31. Write five general characteristics of d block element.

32. Calculate C – F bond length of covalent radius of C = $0.77A^0$, F = $0.72\ A^0$, $X_c = 2.5$, $X_f = 4.0$

33. What are the formula of ionic radius of cation and anion by Pauling method?

34. Find the ionic radius of the ion in KCl if intermolecular distance of KCl is $3.14\ A^0$. The effective nuclear charge of K^+ and Cl^- ions are 7.40 and 5.40 respectively.

35. Write the decreasing order of C, Al, Si and explain.

36. Explain why I.E of Be is more than B.

37. Explain why I.E of N is more than O.

38. Explain why I.E of Li^+ > I.E of the d.

39. Electron affecting of N is positive. Explain.

40. Electron gain enthalpy of F is less than Cl.

41. Give difference between electron affecting and Electro negativity.

42. Give the relationship between Pauling scale and Mullikan scale foe electron.

43. On basis of electro negative concept explain the basic nature of NaOH.

44. Hcl (g) is polar covalent but Hcl (aq.) is ionic.

45. Calculate lattice energy of Nacl using the data electronic charge 4.8×10^{-10}esu.

    Born exponent = 9

    Madelung constant for Nacl = 1.748

    Ionic radius of $Na^{+} = 0.85A^{0}$, $Cl^{-} = 1.8\ A^{0}$

46. Calculate lattice energy of MgF_2 from following data

    $\Delta H_{sub} = 146.4$ KJ mol^{-1}

    $\Delta H_D = 158.8$ KJ mol^{-1}

    $IE_{mg} = 2186.0$ KJ mol^{-1}

    EA = -332.6 KJ mol^{-1}

    ΔH_f of Mgf = -1096.5 KJ mol^{-1}

47. How electron affinity of atom can be calculated by Born Haber cycle?

48. Describe five characteristic of Ionic compound.

49. What is inert pair effect? Give example.

50. Write two limitations of radius ratio rules.

51. Define resonance energy and resonance hybrid.

52. Draw resonance structure of Co molecule.

53. Draw resonance structure of CO_3^{2-} molecule.

54. Draw resonance structure of O_3 molecule.

55. What are non equivalent hybrid orbital's, give example.

56. What is the structure of $[Ni(CN)_4]^{2-}$ on basic of VBT?

57. Write 4 postulates of MOT.

58. Write MO configuration of O_2.

59. Write MO configuration of N_2^{2-}.

60. Draw MO diagram of He_2.

61. Draw MO diagram of Be_2.

62. Find bond order of O_2^{2-} and state whether it is para magnetic.

63. What is HUMO and LUMO?

64. Which of the following species has short bond length No or No^{+}.

65. Why shape of NH_3 is pyramidal?

66. State Fajan's rule.

67. Explain the size order of $Al^{3+} < mg^{2+} < Na^{+}$.

68. What are the favourable character of for ionic character according to fajan's rule?

69. What are the favourable condition for covalent character according to Fajan's rule?

70. Calculate % ionic character of Hcl given $\mu_{experimental}$ = 1.03D and $\mu_{theoretical}$ = 6.1D.

71. What are Keesom forces?

72. Why BF_3 is planer and NF_3 is pyramidal?

73. Why $AlCl_3$ is covalent and AlF_3 is ionic?

74. What are the products of electrolysis of aqueous solution of $CuSO_4$.

75. Calculate the max work available for redox reaction at 25^0C for the cell.

$Zn(s) / Zn^{2+}$ (0.0004m) // Cd^{2+} (0.2m) / Cd(s)

76. Explain auto oxidation with example.

Group-D

Each question carries 8 marks.

1. (a) Derive Schrodinger wave equation for H-atom and give its importance.
   (b) What are quantum numbers? Briefly describe all the quantum numbers.
2. (a) What is shielding effect? Describe various Slater's rules to calculate shielding constant.
   (b) Write Notes on :-
      (i) Ionisation Enthalpy
      (ii) Electronegativity
3. (a) Define Lattice energy. Derive Born-Lande equation for calculation of Lattice energy.
   (b) Discussion valence bond theory to explain the nature of co-valent bond and explain its Limitations.
4. (a) What is metallic bond? Explain Band theory to explain metallic bond.
   (b) What is vander Waal's force? Discuss the origin of different types inter molecular forces and factors affecting this force.
5. (a) Give the MO structure of NO with magnetic character and stability. Compare the stability of NO_2, NO^+ and NO^-
   (b) What are the postulates of VSEPR theory? On thin basic, explain the structures of CIF_3 & ICl_2.
6. (a) What are the different quantum numbers known? Explain the significance of each Quantum number.
   (b) Calculate the wave number of emitted spectral line when electron jumps from (i) n=3 to n=1 and (ii) n=2 to n=1 in a hydrogen atiom.
7. (a) Write the Schrodinger wave equation for atomic model indicating all terms and draw the graphical representations of radial distribution functions of 3s and 3d orbitals.
   (b) Calculate the de Broglie wavelengths of an electron moving with $1/10^{th}$ of light speed

and a bullet (m=2gm.) moving with a speed of 300ms^{-1}. Comment on the result.

8. (a) What is the ionisation energy? Discuss the factors affect the ionisation energy

(b) The radius of F^- and K^+ are same, yet the hydration energy of F^- is greater than that of K^+. Explain.

9. (a) Valence shell electeronic configuration of both Ca and Zn is $4s^2$ but first ionisation energy of Ca is lower than Zn. Justify.

(b) $(SiH_3)_3N$ and $(CH_3)_3N$ react with HCl to give different products. Explain.

10. (a) Draw the molecular orbital diagrams of O_2^+ and O_2^- and calculate the bond order.

(b) Draw the Born-Haber cycle for formation of Nal from their elements.

11. (a) NO molecule prefers to form NO^+. Explain.

(b) Deduce the shape of the NH_3 and PF_5 from VB theory.

12. (a) Write the principle and redox reaction involved in Fe (II) estimation by $K_2Cr_2O_7$.

(b) Give an account of dipole-dipole and ion-dipole forces with examples.

(c) $KMNO_4$ acts as stronger oxidising agent in acidic solution compared to neutral medium. Explain

(d) How does volume increase on freezing of liquid water to ice?

13. Write notes on the following :

(a) Band Theory of metallic bonding

(b) Slater's rule

14. Write notes on the followings:

(a) Derive the geometry of NO_3^- and ClO_3^- ions.

(b) Describe the trend of ionic radii and covalent radii in first transition metals.

15. Give the MO diagram of O_2 .Compare its stability with O_2^- ,O_2^{-2} and O_2^+.

16. State and explain structures and hybridizations of ICl_2^- , PCl_5 and C_2H_4.

17. What is vander Waal forces? Explain all the three types of its interaction.

18. State and explain Fajan's rules. What are its consequences?

19. State and explain hydrogen bonding. What are its applications? Why boiling point of water is more than that of H_2S?

20. Give the principle and procedure involving extraction of ferrous iron from its salt solution.

Physical Chemistry **Core -II**

Group- A

Each question carries 1 marks.

1. The Kinetic energy of the gas molecules are _____ with rise in temperature.

2. The pressure of the gas due to_____.

3. The large fraction molecules moving with velocity at given temperature is called _____.

4. At temperature increases, the most probable velocity of the molecules are _____.

5. The probability of the molecules are _____ with rise in temperature.

6. The collision frequency of the molecules are _____ with increase in molecular diameter.

7. As temperature, the collosion frequency of the molecules are _____.

8. When molecular diameter increases, the mean free path of the molecules are _____.

9. The mean free path of the molecules are increases when pressure of the gas _____.

10. At _____temperature and _____pressure, the real gases approach towards ideality.

11. The unit of vander-Wall's constant 'a' is _____.

12. At _____ temperature and _____ pressure, the gases are deviate from ideality.

13. The unit of vander-Walls constant 'b' is _____.

14. The temperature below which the gases are liquefied under pressure is called _____.

15. Vander-wall's equation for 1 mole is _____.

16. Vander-wall's equation in valid for _____ gas only.

17. The value of Critical co-efficient RT_C/T_cV_c = _____.

18. The law of corresponding state is _____.

19. The value of critical Vd. In terms of vander-Walls constant is _____

20. The surface tension of the liquid_____with rise in temperature.

21. A shaving blade & needle floats on water surface due to _____.

22. Small liquid drops are always spherical in shape due to _____.

23. The S.I unit of surface tension is _____.

24. Liquid rise in the capillary tube due to_____.

25. The viscosity of the liquid is _____with rise in temperature.

26. The practical unit of co-efficient of viscosity of liquid is _____.

27. The viscosity of liquid is _____ with increase inter molecular forces.

28. For given liquid, the viscosity is _____ with increase in molecular cut.

29. The S.I unit of co-efficient of viscosity of liquid is _____

30. On dilution, the degree of dissociation α is _____.

31. For endothermic substance, the degree of dissociation is _____ with rise in temperature.

32. For exothermic substance, the degree of dissociation is _____with rise in temperature.

33. Due to common ion, the degree of dissociation 'α' is_____.

34. The value of K_w at 25^0C is _____.

35. The value of K_w is _____ with rise in temperature.

36. The pH of solution _____ with rise in temperature.

37. The sum of p^H and p^{OH} is _____.

38. If the p^H of solution is greater than 7, the solution is _____ in nature.

39. In pure water, p^H is _____.

40. In acidic solution, P^H is_____ than 7.

41. _____ solid has sharp MP.

42. _____ solid is anisotropic in nature.

43. The defect in which pair of holes are developed called_____.

44. The defect in which cation is shifted to the interstitial sites called _____.

45. Henderson equation for acidic buffer is _____.

46. Henderson equation for basic buffer is _____.

47. NaCl is _____ stable than CsCl.

48. The small unit which define completely 3D structure of solid is called_____.

49. The NH4Cl dissolve in water to produce _____ solution.

50. The p^H of an aqueous solution of NaCl is _____.

Group-B

Each question carries 1.5 marks

1. What is the value C_P / C_V for CO_2?

2. In between H_2 and O_2 molecule, which will have higher kinetic energy at 25^0C?

3. Define Collision diameter.

4. Arrange H_2, O_2 and CO_2 in the order of their deviation from ideality under similar condition of temperature and pressure.

5. What is the co-ordination number of each ion of C_SCl?

6. What do you mean by anisotropy in solids?

7. How does the viscosity of water vary with the dissolution of covalent solutes?

8. What is the effect of temperature on vapour pressure of liquid?

9. What is ionic product of water?

10. What is that substance on mixing with NH_4OH gives a buffer?

11. Define compressibility factor.

12. In vander Waals gas, describe the term which accounts for intermolecular forces.

13. What is law of equipartition of energy?

14. Name four important physical properties of liquid.

15. How many crystal systems and Bravies lattices are there for solids.

16. Which crystal plane have interplanar spacing $d_{hkl} = \sqrt{12}$?

17. Calculate the pH of 0.04M HNO_3 solution assuming complete dissociation.

18. Define solubility product.

19. What is the Henderson-Hasselbalch equation?

20. What is buffer capacity?

21. Define collision number.

22. What is mean free path? Give the equation.

23. Define coefficient of viscosity. Give the equation.

24. What is root mean square velocity? Give the equation.

25. What is most probable velocity? Give the equation.

26. What is compressibility factor?

27. Define degrees of freedom.

28. Give real gas equation for 1 mole of gas.

29. Find out rms speed of CO_2 at 27 ^oC.

30. Define equipartition of energy.

31. Define surface tension. Give its unit.

32. Define vapour pressure.

33. What is ionic product of water. Give its equation.

34. Define common ion effect.

35. What is pH of 1M HCl/ 0.001M NaOH?

36.Define law of rational indices.

37. Define law of constancy of interfacial angle.

38. Give Bragg's equation.

39. Define solubility. Give equation.

40. Define solubility product. What is the solubility product of AgCl.

41. Give the relationship between solubility and solubility product.

42. What is the solubility product of AgCl whose solubility is 10^{-8} g^2/l^2 at 97 ^{0}C ?

43. Define an indicator with an example.

44. What is buffer solution? Give an example.

45. Give Henderson-Hasselbalch equation for acidic buffer.

46. Give Henderson-Hasselbalch equation for basic buffer.

47. What is the pH of 0.63 g of HNO_3 dissolved in 200 ml of solution?

49. Give the formula of Miller indices.

50. What is the pH of blood?

Group- C

Each question carries 2.5 marks.

1. Write the equation for probability of finding of molecules with velocity c.

2. Define and give formula of average velocity.

3. What is rms velocity and give its formula?

4. Calculate rms speed of an Oxygen molecule at 288K in SI unit.

5. Calculate ration of rms velocities of O_2 and HI at 320K.

6. Calculate kinetic energy (in joules) of 1 mole of ideal gas at 320K.

7. A linear molecule and a linear molecule how many vibrational degree of freedom.

8. Calculate the no of modes of vibration in case of CH_4 molecule.

9. What is law of equipartition of energy?

10. Using principle of equipartition of energy and various degree of freedom estimate the value of C_V for SO_2 (sent molecule).

11. What is collision frequency? Write its formula.

12. Give formula of mean free path. Give its formula and explain its terms.

13. Calculate mean free path of O_2 molecule at 298K and 10^{-3}mm Hg. Given =3.61 x 10^{-10}m.

14. Why correction in volume factor necessary in ideal gas equation?

15. Write the units of van der Waal constants a and b.

16. Define Critical pressure, critical volume, critical temperature.

17. Calculate the T_C for a van der Waal's gas for which P_C is 100 atm and b is 50cm^2 mol^{-1}.

18. What is compressibility factor and name the gases which show positive deviation at all pressure?

19. State vapour pressure. Give the factors affecting it.

20. Name two factors and explain how they affect vapour pressure.

21. What is continuity of states? Explain.

22. Explain the cleansing action of soap.

23. Derive Ostwald's dilution law.

24. 0.1m solution of monobasic acid dissociation to the extent of 10%. Calculate dissociation constant of the acid.

25. What happens to the p^H when a few drops of acid or alkali are added to CH_3COONH_4?

26. Define Crystal lattice, Unit cell, Lattice point.

27. What is difference between Weiss and Miller indices?

28. What is formula of interplanar distance?

29. Write notes on Schottky defect.

30. Write notes on Frenkel defect.

31. What are nematic liquid crystals? Give example.

32. What are cholestric liquid crystals? Give example.

33. State and explain surface tension. Give its unit.

34. What is coefficient of viscosity? Give the equation and unit.

35. Explain two factors affecting surface tension.

36. State and explain p^H.

37. State and explain ionic product of water.

38. State and explain common ion effect with an example.

39. How can common ion effect help in the separation of group II cations?

40. What is element of symmetry? Explain.

41. What is line of symmetry? Explain.

42. State and explain law of constancy of interfacial angle.

43. Give the powder diffraction pattern of NaCl.

44. What is a liquid crystal? Explain.

45. What is a buffer solution? Give one example of each acidic and basic buffer.

46. What are buffer capacity and buffer range? Explain.

47. Derive Henderson's equation for acidic buffer.

48. Give the theory of acid base indicator.

49. Define solubility and solubility product.

50. Derive the relationship between solubility and solubility product.

Group -D

Each question carries 8 marks.

1. (a) Derive kinetic gas equation, $PV = \frac{1}{3}mNu^2$

   (b) What is mean free path? Discuss the various factors affecting it.

   (c) Discuss the law of equipartition of energy.

2. (a) Reduce van der Waal's equation to viral form and calculate Boyle temperature from this.

   (b) Give the significance of vander Waal's constants.

   (c) Derive vander Waal's equation of state for 1 mole of a real gas?

3.(a) Give an account of powder pattern method for study of crystals.

   (b) In a diffraction experiment, angle of diffraction (Q) is 17^0 and wavelength of x-ray used is 136pm. Calculate the distance between the layers of atoms assuming n=1.

4. (a) Discuss the law of rational indices and Miller indices.

   (b) What are liquid crystals? Discuss the structure of various types of liquid crystals.

5. (a) Calculate the pH of 10-3 (M) HCl

   (b) Discuss the cleansing action of soap and detergents.

6. (a) Discuss the structure of liquids by means of distribution curve making comparison with solids and liquids.

   (b) Establish the relation between dissociation constant of a weak mono basic acid and its degree of dissociation.

7. (a) Discuss Ostwald's theory of acid-base indicator considering the case of Phenolphthalein.

   (b) Why does solution of CH_3COONH_4 act as a buffer?

8. (a) Define hydrolysis of salt. Derive an expression for the calculation of pH of CH_3COONa solution.

   (b) Calculate the solubility of AgCl in presence of 0.01(M) HCl at 25^0C where the solubility of AgCl is 10^{-10}.

9. (a) Discuss in details, the Maxwell's distribution of molecular velocities.

(b) Derive the vander Waals equation of state for real gases. Explain how this equation explains the departure of real gases from ideal behaviour at different pressure and temperature

10. (a) Define the term surface tension and surface energy. Derive an expression for determination of surface tension by capillary rise method.

(b) Discuss the following :

(i) Common ion effect

(ii) Ionisation of weak acid and bases.

(iii) Find pH of 1 x 10^{-5}M solution of

(a) NaOH (b) $Ba(OH)_2$

11. (a) Discuss the rotating crystal method and powder pattern technique for determination of crystal structure of solid

(b) Discuss the Schottky and Frenkel defect in solid.

(i) Common ion effect

(ii) Ionisation of weak acid and bases.

12. (a) Discuss in details, the phenomenon of hydrolysis of salts taking examples of :

(i) A weak acid and a strong base

(ii) A weak base and a strong acid

(b) Give an account for the qualitative treatment of acid base titration curve taking example of: (i) A strong acid with a strong base

(ii) A weak acid with a strong base

Organic Chemistry

Core – III

Group - A

Each question carries 1 mark. (Fill in the blanks)

1. In open chain compounds, the 'c' atom is connected with _____ no. of 'c' atom directly maximum.

2. One physical property of compound is mainly depends upon _____.

3. _____ part of the compound is responsible for chemical properties.

4. – O – is the functional group of _____ family.

5. The F.G at esters is _____.

6. The IUPAC name of the compound $CH_2 = CH – \underset{\underset{|}{Cl}}{C} =CH – CH_3$ is _____

7. The IUPAC name of the compound $CH_3 – CH_2 – \underset{\underset{|}{COOH}}{CH} – CH_2 - CH_2 – CH_3$ is _____

8. The IUPAC name of the compound $CHO – CH – \underset{\underset{|}{Cl}}{CH_2} – CHO$ is _____

9. The IUPAC name of the compound $\underset{\underset{|}{COOH}}{COOH}$ is _____

10. The IUPAC name of the compound $\underset{\underset{|}{CH2 – CN}}{CH2 – CN}$ is _____

21. As the bond strength increases, then the bond length is _____.

22. As S- character increases, the bond angle is _____.

23. As S- character of bonded electron increases, the bond energy is _____.

24. Polarisation of single bond is called _____.

25. – I effect group _____ the clarity of the substance.

26. Formic acid is _____ than acetic acid.

27. +I effect _____ the acidity of the substance.

28. α- electro acetic acid is _____ than p- cloro acetic acid.

29. Aniline is _____ them ethylamine on basic strength.

30. Chloro acetic acid is _____ than fluro acetic acid on the acid strength.

31. Phenol is unit due to_____.

32. The transfer of π- electron in the presence of reagent is called _____.

33. An electron rich species is called_____

34. _____ exchanges produce free radicals.

35. An electron deficient species is called _____.

36. Heterolytic cleavage produce _____ fragments.

37.Carbon carries +ve change is called _____

38. _____ carbon intermediate is nucleophile in nature.

39. Carbine contains _____ no. of electron.

40. Free radical is _____ stable than nuclear molecule from which it is formed.

41. _____ type of alkanes are produce in water reaction.

42. _____ type compound shows geometrical isomerism.

43. Meso compounds are optically _____ in nature.

44. Lactic acid contain _____ no. of chiral centre.

45. The compounds which are mirror image to each other called _____.

46. The mixture contain 50% d and 50% 1 called _____

47. Alkenes shows _____ type of reaction.

48. Alkene is _____ reactive than alkyne forwards electrophilic addition reaction.

49. According to Saytzeffs, _____ alkene is stable.

50. _____ theory determine the stability of alicyclic compound.

51. In sulphonation of benzene, _____ is an electrophile.

Group-B

Each question carries 1.5 marks

1. How many sp hybridised carbon atoms ate there in

   $CH_2 = C = CH - CH_2 - C \equiv CH$

2. In between water molecule and CH_3OH molecule which has higher dipolement?
3. Draw the structure of syn and anti acetaldoxime.
4. Meso compounds are optically inactive due to_____.
5. n-propane reacts with Cl_2 in 1:1 ratio under the influence of u.v. light to give_____.
6. What happens when Al_4C_3 is hydrolysed by boiling with water?
7. What is produced when propyne undergoes hydration with 30% dil. H_2SO_4 in presence of Hg^{2+} salt?
8. In between alkenes and alkynes, which are more reactive towards electrophilic addition reaction?
9. What is that electrophile acting during sulphonation of benzene?
10. Select the activating substituent's for elctropholic substituents across benzene ring.

    – Cl, $-CH_3$, $-NH_2$, –COOH.

11. In between aniline and benzyl amine, which is more basic?
12. What is the shape of $^{+}CH_3$ ion?
13. Racimic mixture is optically inactive due to_____.

14. Write the Fischer projection formula of 2-chloro butane.

15. Among the different conformational isomers of cyclo-butane, which is more stable?

16. What is the order of selectivity of carbon atoms for halogenations?

17. What is the major product when propene reacts with HBr in the presence of organic peroxide?

18. $CH_3 - C \equiv C - CH_3 + H_2 \xrightarrow[\text{xylene}]{\text{Pd-BaSo4}}$ A (What is A?).

19. What is the name of electrophile acting during sulphonation of benzene?

20. Give an example of a cyclic carbanion having aromatic nature.

21. What is the shape and hybridisation of acetylene?

22. Define homolytic bond fission with one example.

23. Define nucleophilic with two examples.

24. What is electrophilic addition reaction? Give one example.

25. Define enentiomer with example.

26. What is Wurtz-Fitting reaction? Give one example.

27. What is ozonolysis of alkene? Give one example.

28. Give one reaction to explain the acidity of acetylene.

29. Which of the two is aromatic and why?

30. What is nitration of benzene? Give examples.

31. What is nucleophile? Give one example.

32. What are the hybridisation, shape and bond angle of acetylene?

33. Define dipole moment with mathematical relation.

34. Why is ethyl amine more basic than methyl amine?

35. What is enantioner? Give one example.

36. What is the formal change on 'C' in CH_3^+?

37. Give the different resonating forms ofi cyclopentadienyl cation.

38. Define Markownikoff's rule with one example.

39. $CH_3 - CH - CH_2 + O_3 \xrightarrow{H2O}$? Complete the reaction.

40. Show all the axial and equatorial H-atoms in chair form of cyclohexane.

41. Define Huckel's rule of aromaticity.

42. Which of the following groups are O & P - directing?

- NO_2, - Cl, - NH_2, - SO_3H

43. Between fluoro acetic acid and chloro acetic acid which is stronger and why?

44. Write the stability order of alkyl free radicals.

45. Give an example of E_2 reaction.

46. Between cis-isomer and trans-isomer which generally possesses lower melting point and why?

47. What is racemisation?

48. Give an example of Nucleophilic addition reaction.

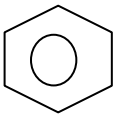
49. Write the product for the following reaction :

$CH_3 - CH = CH_2 \xrightarrow{NBS}$

50. Give an example of anti-Markownikoff's addition reaction.

51. State Huckel's rule.

52. Complete the following reaction.



+ CH3CH2CH2Cl $\xrightarrow{\text{Anhy ALCL3}}$

53. What is an electrophile? Give one example.

54. What does half headed arrow indicate?

55. Give the factors responsible for the order of basicity of 1^0, 2^0 and 3^0 amines in aqueous solution.

56. Find out the formal charge on carbon in CH_3^-.

57. Why is phenoxide ion stable?

58. Define diastereomers with example.

59. Represent cis and trans isomers of the compound

HOOC – CH = CH – COOH and write their names.

60. What is Wurtz-fittig reaction? Give example.

61. Why is cyclopropane unstable according to Baeyer-strain theory?

62. Give nitration of benzene. What is the electrophile in this reaction?

Group -C

Each question carries 2.5 marks.

1. Give an example of α- Elimination.

2. What is Cope reaction? Give an example.

3. $CH_3 - \underset{\displaystyle OH}{\underset{|}{CH}} - CN \rightleftharpoons$ Predict the product using E_{ICB} mechanism

4. Show mechanism of Markownikoff addition. Why the halogen is added to C having lower no. of H atom?

5. Why is presence of peroxide during addition of HBr to alkene, the Br goes to C having higher no of H atom.

6. What is regioselective reaction? Give one example.

7. Show mechanism of Hydroboration reaction.

8. 1,3- butadiene + Maleic anhydride $\xrightarrow[\text{quantitative}]{\text{benzene, 20 C}}$ _____

Complete the product and name the reaction.

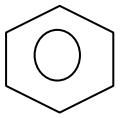
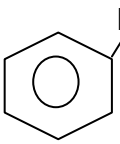
9. Write the postulates of Bayer Strain theory.

10. Write two difference of Saytzeff and Hofmann elimination.

11. $CH_3 - CH \equiv C - CH_3 \xrightarrow[\text{Quinoline}]{\text{Pd/BaSo4}}$ _____

$CH_3 - CH \equiv C - CH_3 \xrightarrow{\text{Na/Liq. NH3}}$ _____

12. Show mechanism of Ozonolysis.

13.  + $HNO_3 \xrightarrow{H2So4}$  + H_2O

14. Explain why –OH group is ortho, para directing.

15. Why Cl is ortho directing although deactivating?

16. How will you convert n-Propyl bromide to n-propane.

17. Identity P, Q, R

$CH_3 - CH2 - CH2 - Br \xrightarrow{\text{alcoholic KOH}} P \xrightarrow{H2O/H+} Q \longrightarrow R$

18. Show the mechanism of benzyne formation from chloro benzene in presence NH_2.

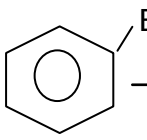
19. What are drawbacks of Kekule structure of benzene?

20. Show mechanism of sulphonation of Benzene.

21. What happen when Benzyl Chloride is subjected to oxidation with Lead Nitrate?

22. What happens when Cl_2 passed through boiling toluene?

23. Identity A and B

 $\xrightarrow[\text{eather}]{\text{CH3Br/Na}}$ A $\xrightarrow{\text{kmnO4}}$ B

24. Identity A, B and C

Toluene $\xrightarrow{\text{KMnO4}}$ A $\xrightarrow[\text{H+}]{\text{NaOH}}$ B $\xrightarrow[\text{H2SO4}]{\text{HNO2}}$ C

25. How benzene converted to acetophenone. Name the reaction.

26. What are the synthetic application of Friedal Craft reaction?

27. What happens when 0- xylene is heated with $KMnO_4$.

28. Show the difference between SN^1 and E_1 reaction in alkyl halide.

29. Show the difference between SN^2 and E_2.

30. What happens when toluene is subjected to chromyl chloride?

31. What is field effect? Explain with one example.

32. Between formic acid and acetic acid which is stronger why.

33. Secondary amine is more basic than tertiary amine. Explain.

34. Aniline is a weaker base than para -toludine.

35. Draw hyper conjugative structure of

$CH_3 – CH = CH_2$

36. What is Carbene. Draw the structure of singlet and triplet Carbene.

37. Draw the structure of cyclopentadienyl carbanion.

38. What is Wurtz reaction? Give two examples.

39. Show the mechanism of chlorination of methane.

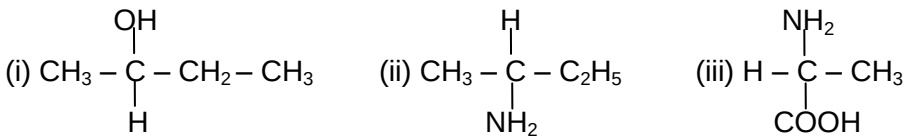
40. Define specific rotation and write the formula.

41. What are the proportions of enantiomers?

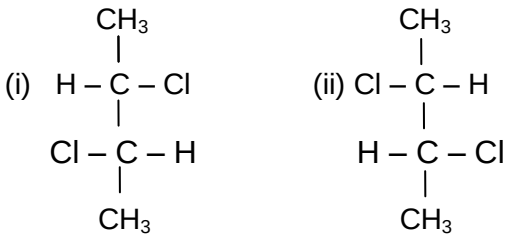
42. What are diastereo isomers? Give examples.

43. What are erythro and threo isomers? Give one example of each.

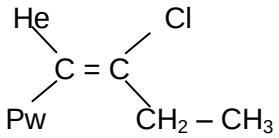
44. Give R and S configuration to

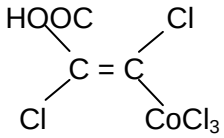


45. Specify the configuration of

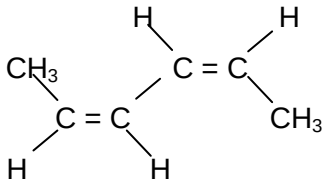


46. Give I, Z notation to





47. Give E, Z notation to



48. What are Carbonations? Arrange the following in order of their stability

$CH_3 – CH_2 – CH_2 – CH_2^+$, $(CH_3)_3\ C^+$, $CH_3 – CH^+ – CH_2 – CH_3$

Group-D

Each question carries 8 marks.

1. (a) Define hyper conjugation. Apply it to determine the relative stability of 1^0, 2^0 and 3^0 carbocation.

(b) In between 2-chloropropionic acid and 3-chloro propionic acid which is stronger and why?

2. (a) What are Carbanion? Discuss their structure and stability.

(b) What are Carbenes? Classify them.

3. (a) What is optical isomerism? What are its conditions? Discuss the optical activity of different stereo isomers of tartaric acid.

(b) How do Cis and trans isomers of compound differ in their physical characteristic.

4. (a) Discuss E/Z notations of geometrical isomers with examples using C.I.P. rule.

(b) How do erantiomers differ from diastereo isomers?

5. (a) Discuss the conformational analysis of cyclohexane with relative stability and energy diagram.

6. (a) What happens when methyl iodide in heater with ethyl iodide in presence of sodium metal in etheral medium? Write with equation.

(b) Why cyclopentane is more stable than cyclopropane?

7. (a) Discuss E_1CB mechanism with an example.

(b) What product is formed when But-1-ene is subjected to hydroboration oxidation? Discuss with mechanism.

8. (a) Discuss the acidic nature of terminal alkynes with supporting reaction.

(b) How can you convert acetylene to propyne?

9. (a) How does benzene react with n-propyl chloride in the presence of anhydrous $AlCl_3$? Write with mechanism.

(b) Discuss the mechanism of nitration of benzene.

10.(a) Why benzene can't be converted into tri-nitrobenzene directly?

(b) Test for the aromaticity for the following species.

(i)  =O

(ii) 

11. (a) Discuss Freundlich adsorption isotherm of a gas in a solid surface. How the constants in this isotherm are are determined.

(b) Write Notes on:-

(i) CMC (ii) Micelles

12. (a) What is adsorption? How does physical adsorption differ from Chemical adsorption.

(b) Write Notes on :-

(i) Zeta potential (ii) Electrophoresis

13. (a) Discuss collision theory of reaction rate.

(b) Derive the rate equation of a second order reaction.

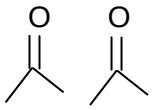
$2A \longrightarrow$ Production

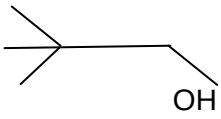
14. (a) Discuss Arrhenius equation for temperature dependence of reaction rate.

(b) How is the order of a reaction determined by

(i) Differential method (ii) Half life method

15. (a) Give the IUPAC name of the following compounds.

(i) 

(ii) 

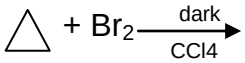
(iii) $CH_2 - CH - CH_2$
CN CN CN

(iv) $CH_3 - CH - CH_2 - COOH$
Br

16. (a) Write Short Notes on 'Hyper conjugation'.

(b) (i) What happens when cyclopropane reacts with HBr.

(ii) Complete the reaction –



17. (a) Write a note on inclusion compounds.

(b) Write notes on Diels-Alder reaction.

18. (a) What are electrophiles and nuclophiles? Illustrate with two examples of each.

(b) Explain with examples the mechanism of SE_1 reaction.

(c) Allyl free radical is more stable than alkyl free radical. Explain.

19. (a) Define the term reactive intermediate.

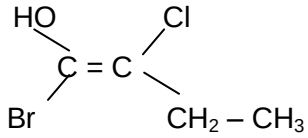
(b) Discuss the structure and stability of carbocation.

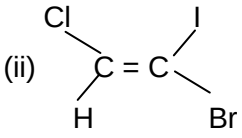
(c) Explain with examples the mechanism of AdE reaction.

20. (a) Differentiate between enantiomers and diastereomers.

(b) What are the principles of deciding R and S notations for chiral centers.

(c) Assign E and Z configuration to the following compounds.

(i) 

(ii) 

21. (a) Discuss conformation of 1, 4-dimethyl cyclohexane.

(b) Draw Newman Projection for chair and boat conformation of cyclohexane.

(c) Write notes on resolution of racemic mixture.

22. Write note on inductive effect. How does the acidity of mono, di and tri-chloro acetic acids explain on thin basic.

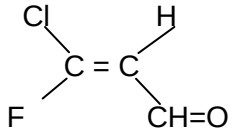
23. What are carbon free radicals? Explain their shape and stabilities. Give different tupes of substitutions with examples.

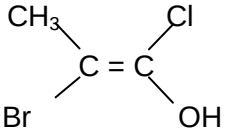
(i) Iodoform reaction

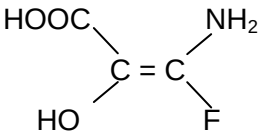
(ii) Diels-Alder reaction

24. Write note on Cis and trans Isomerism.

Represent the following compounds as E or Z Isomer.

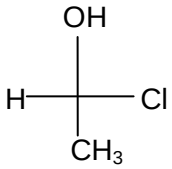


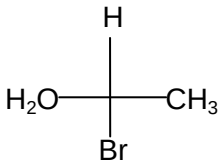




25. (a) What is Racemic mixture? Give two methods of resolution of racemic mixture.

(b) Identity the followings compounds on R or S configuration.





26. Write notes on with mechanism.

(a) Wurtz reaction

(b) Chlorination of Methane

27. Write Notes on :-.

(a) Baeyer Strain theory

(b) Confirmational analysis of butane

28. Write notes on ***(any Two)***:-

(a) E_2 reaction

(b) Markownikoff's reaction

(c) Oxymercuration - demercuratin reaction.

29. Write Notes on ***(any Two)***:-

(a) Diel's-Alder reaction

(b) Saytzeff's rule

(c) Syn-hydroxylation of alkene

30. Write notes on ***(any Two)***:-

(a) Huckel's rule of aromaticity

(b) Friedel-Craft acylation

(c) Chloro benzene is o, p- directing but deactivating for electrophilic substitution.

31. Write Notes on ***(any Two)***:-

(a) Halogenation

(b) Sulphonation

(c) Benzoic acid is meta directing and deactivating for electrophilic substitution reaction.

32. (a) Define adsorption. Discuss Freundlich adsorption isotherm and write its limitation.

(b) Write notes on :

(i) Zetapotential (ii) Brownian movement

33. (a) State and derive Gibb's adsorption isotherm.

(b) What are the differences between physical adsorption and chemical adsorption?

34. (a) What is the zero order reaction? Derive an expression for the rate constant of a zero order reaction. Give one example of a zero order reaction.

(b) Discuss the different methods of determining the order of a chemical reaction.

35. (a) What is a second order reaction? Derive an expression for the rate constant of a second order reaction. $2A \longrightarrow$ Product. Give one example of second order reaction.

(b) Write Notes on :

(i) Half life period (ii) Activation energy

36. (a) Write the IUPAC name of the following compounds.

(i) $CH_3 - \underset{CN}{\underset{|}{CH}} - \underset{CN}{\underset{|}{CH}} - \underset{CN}{\underset{|}{CH_2}}$

(ii) $CH_3COCH = CH - COOH$

(iii) $CH_2 - CH = CH_2$ (with a cyclopropane ring)

(iv) $CH_3 - \overset{O}{\overset{||}{C}} - CHO$

(v) $CH_3 - C \equiv C - \underset{CH_3}{\underset{|}{CH}} - CH_3$

(b) Write Notes on :-

(i) Steric effect

(ii) Diels Alder reaction

(iii) Hyper conjugation

37. (a) Write the structural formula of the following compounds.

(i) 4, 5-dimethyl – 2 – hexyne

(ii) 2-Butenoic acid

(iii) 3-chloro-2-ethyl-butanol

(iv) N-ethyl-2-amino propane

(v) 4-Bromo-3-buten-2-one

(b) What is resonance? What are the essential conditions for resonance. Write any two of its applications.

38. (a) What is carbocation? Explain the structure, stability and formation of carbocation.

(b) What are electrophiles and nucleophiles? Give example of different types of electrophiles and nucleophiles.

39. (a) What do you understand by and and AdE reaction? Explain them with suitable examples.

(b) Write Notes on :- \

(i) Free radical

(ii) Benzyne

(iii) Nitrenes

40. (a) What do you mean by Geometrical isomerism? Discuss the geometrical isomerism in aldoxime and Ketoxime.

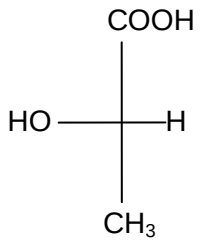
(b) Write Notes on :-

(i) Optical isomerism

(ii) Enantiomers

(c) Write R and S notation of the following compounds :-

(i)



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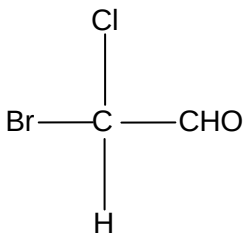
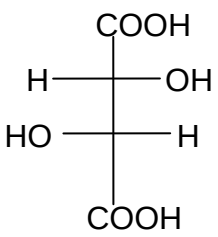


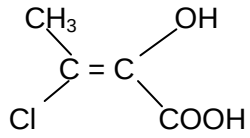
(iii)

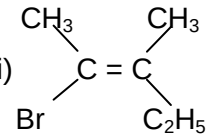


41 (a) Discuss the conformation of cyclohexane and their relation stability.

(b) Explain the term conformation and configuration.

(c) Write the E and Z notation of the following compounds.

(i) 

(ii) 

42.(a) Write note on Resonance.

(b) Why is chloro acetic acid stronger acid than acetic acid?

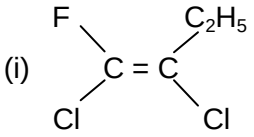
(c) What is substitution reaction? Explain with example.

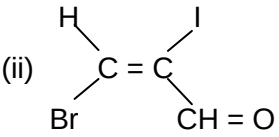
43. (a) Discuss the structure and stability of carbenes.

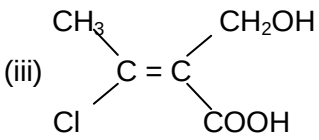
(b) Write note on Wurtz-Fitting reaction.

44.(a) State and explain E and Z isomerism with necessary conditions involved.

(b) Assign E and Z configuration of the following compounds.

(i) 

(ii) 

(iii) 

45. (a) What is racemic mixture? Give three important methods of resolution of racemic mixture.

(b) What are important conditions for a compound to be asymmetric?

46. Write Notes on:

(a) E_2 reaction (b) Ozonolysis

(c) Hofmann Elimination

47. Write Notes on :

(a) Hydroboration-oxidation reaction

(b) Hydration of acetylene

(c) Anti-Markownikoff's addition.

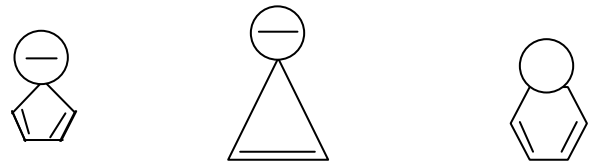
48. (a) Discuss the different conformations of ethane with potential energy diagram.

(b) Give the different conformations of n - butane.

49. (a) Write energy diagram, show the different conformations of cyclohexane. Which form is stable form among them.

(b) What is electrophillic aromatic substitution reaction? Give the mechanism of nitration of benzene.

(c) Which of the following compounds / ions are aromatic and why?



50. (a) Write Notes on :-

(i) Halogenation

(ii) Nitration

(b) Why is phenol and p-directing and activating? Explain.

51. Define resonance. What are the conditions of resonance? How does resonance explain acidic character of phenol?

52. What are Carbonations and carbanions? Explain their structure and stability.

53. Define Geometrical isomerism. What are the conditions if Geometrical isomerism? Explain cis-trans and syn-anti isomers with examples

54. What are enantiomers and diastereo isomers? How they can be distinguished?

55. Discuss the formation of alkane by elimination reaction and also its mechanism. How does propane react with HBr in presence and in absence of organic peroxide?

56. Discuss Baeyer Strain theory. How does it explain the relative stability of cyclo alkanes? Write its limitations.

57. Discuss Friedel-Craft's alkyation and acylation of benzene with mechanism.

58. Explain the following :

(a) Nitration of toluene takes place more readily than that of benzene.

(b) – OH group in phenol is ortho-para directing.

(c) – CHO group in benzaldehyde is meta directing.

(d) Chlorine deactivates to benzene ring yet it is ortho-para directing.

59. Write the following reactions with mechanism **(Any Two):**

(a) Diel's Alder Reaction

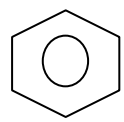
(b) Wurtz-Fittig Reaction

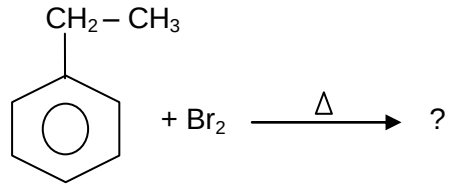
(c) E_1cb Reaction

60. Complete the following reactions and name the product:

(a) $CH_3 - C \equiv CH + H_2O \xrightarrow[H_2SO_4]{Hg2+} ?$

(b) $CH_3 - CH = CH - CH_3 \xrightarrow[(ii)\ Zn\ dust]{(i)\ O_3} ?$

(c)  $+ CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}} = CH_2 \xrightarrow{H+} ?$

(d) 

61. Define resonance. Give six important conditions of resonance with example.

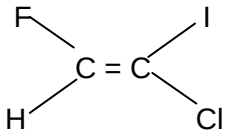
62. Write Notes on :- ***(any Two)***

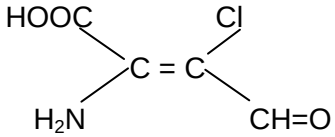
(i) Carbocation

(ii) Inductive effect

(iii) carbene

63. What do you mean by E, Z notation? Write the sequence rules for assigners E and Z configuration to the geometrical isomer. Assign E or Z configuration of the following compounds.





64. What is resolution of racemic mixture. Discuss various methods of resolution of racemic mixture.

65. Write Notes on :-

(a) Wurtz reaction

(b) Reactivity and selectivity on halogenation of alkane.

66. Give the postulates of Baeyer strain theory. On this basis explain the stabilites of cyclo- alkanes.

67. Write Notes on :-

(a) E_2 reaction

(b) Diels-Alder reaction

68. Write Notes on :-

(a) Saytzeff Rule

(b) Oxymercuration demercuration of alkene.

69. Write Notes on :-

(a) State and explain Huckel's rule of aromaticity.

(b) Write Friedel-craft acylation reaction with mechanism.

70.(a) Give halogenations reaction of benzene with mechanism.

(b) Why is halogen atom in Halo-benzene o and p-directing but deactivating?

71. (a) Define Hyper conjugation. Apply it to determine the relative stability of the following

carbocation.

CH_3^+ , $(CH_3)_2\overset{\oplus}{C}H$, $(CH_3)_3\overset{\oplus}{C}$

(b) Arrange the order of basic nature of

NH_3, CH_3NH_2, $C_6H_5NH_2$ with explanation.

72. (a) What is cabenes? Discuss its classification and structure.

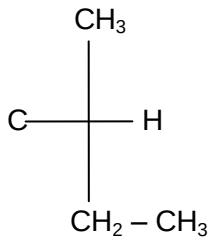
(b) Arrange the stability order of the following carbanions with reason.

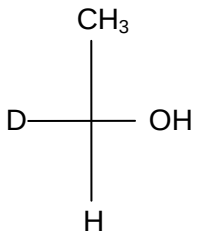
$CH_3 - \overset{\ominus}{C}H_2$, $CH_2 = \overset{\ominus}{C}H$, $CH \equiv \overset{\ominus}{C}$

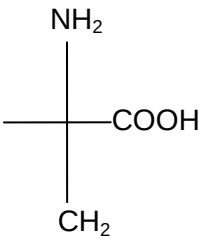
73. (a) Distinguished between Enantiomers and Diastereo isomers with examples.

(b) Assign R and S configuration to the following compounds.

c) Write R and S notation of the following compounds :-

(i) 

(ii) 

(iii) 

74. (a) Distinguish between threo and erythro diastero isomers with examples.

(b) Explain the terms Chiral, achiral and pro-chiral as applied to stereo chemistry.

75. Write Notes on :-

(a) Wurtz-Fitting reaction

(b) Iodination of alkane

76. Discuss the various confirmations of cyclohexane with relative stability and necessary energy diagram.

77. Write Notes on :-

(a) Antimarkownioff's rule

(b) Mechanism of E_1CB reaction.

78. Write Notes on :-

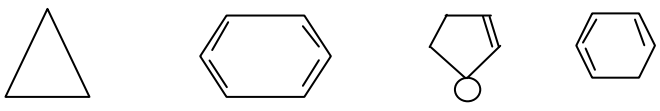
(i) Hydroboration oxidation of alkenes.

(ii) Acidity of terminal alkynes.

79. (a) Discuss the mechanism of nitration of benzene.

(b) What happens when benzene reacts with n-propyl chloride in the presence of anhydrous $ALCl_3$? Discuss with mechanism.

80. (a) Apply Huckel's (4n+2) rule to test the aromaticity of the following species.



(b) Arrange benzene, nitrobenzene and toluene in the order of their reactivity towards electrophilic substitution reaction with appropriate expiation.

81. (a) Write the IUPAC name of the following compounds :-

(i) $CH_3 – CH = CH – CH_2 – CH_3$

(ii) $CH_3 – CO – CH_2 – CO – CH_3$

(iii) $OHC – CH_2 – CH_2 – \underset{\displaystyle CH_3}{\underset{|}{CH}} – CHO$

(iv) $\overset{\displaystyle OH}{\overset{|}{CH_2}} – \overset{\displaystyle OH}{\overset{|}{CH}} – \overset{\displaystyle OH}{\overset{|}{CH_2}}$

(v) $HOOC – CH_2 – \underset{\displaystyle CH_3}{\underset{|}{CH}} – COOH$

(vi) $CH_3 – CH = CH – C \equiv CH$

(b) Write Note on : (i) Inductive effect.

(ii) Hyper conjugation

82. (a) Write the structural formula of the following compounds :-

(i) 1, 3-Butadiene

(ii) 4-methyl - 2 - Pentyne

(iii) But-1-yne

(iv) Pent-3-ynal

(v) 3-Butyn-2-one

(b) Write Notes on :

(i) Dieckmann's reaction

(ii) Bayer's Strain Theory

83. (a) What is Carbanion? Discuss the formation, structure and stability of Carbanion.

(b) Define the term Carbene. What are singlet and triplet carbine?

84. (a) Discuss the mechanism of SN1 and SN2 reaction with suitable examples in each case.

85. (a) Discuss various confirmations of n-butane with special reference to their stability.

(b) Differentiate between axial and equatorial bonds.

(c) Give 'R' and 'S' configuration to each of the following compounds.

(i) $F – \underset{\displaystyle I}{\underset{|}{\overset{\displaystyle Cl}{\overset{|}{C}}}} – Br$

(ii) $HO – \underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle COOH}{\overset{|}{C}}}} – H$

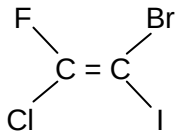
86.(a) What is optical isomerism? Discuss the optical Isomerism of Tartaric acid.

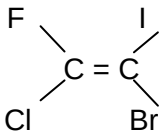
(b) Write Notes on :-

(i) Diasteromers

(ii) Meso compounds

(c) Give E and Z notation to the following compounds.

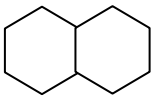


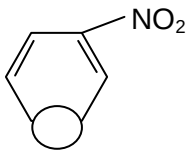


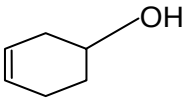
87. (a) Writ IUPAC name of the following compounds.

(i) $HOOC - CH_2 - \underset{\displaystyle COOH}{\underset{|}{CH}} - CH_2 - COOH$

(ii) $NC - CH_2 - CH_2 - COOH$

(iii) 

(iv) 

(v) 

(b) Define resonance. Draw the resonating structures of benzene. The enthalpy of hydrogenation of hypothetical cyclo hexatriene is 85.8 kcal / mole while that of benzene is 49.8 kcal / mole. Calculate the resonance energy of benzene and explain its stability.

(c) Explain intramolecular hydrogen bonding with an example. How does it influence boiling Point of a compound?

88. (a) Write the structure formulae of the following compounds :

(i) N, N-Dimethylaniline

(ii) 2 – Ethoxybutane

(iii) 3 - Iodobutanamide

(iv) 0 – Toludine

(b) Write notes on the following :

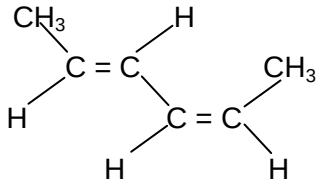
(i) Clathrates

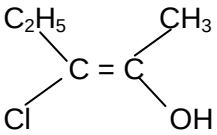
(ii) Aromaticity

89. (a) What are Carbanions? Explain the stability order of the following carbanions.

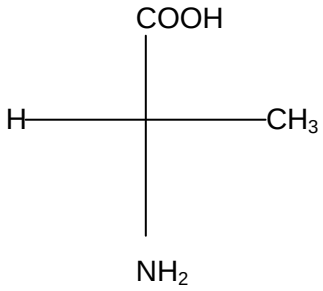
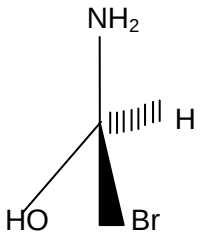
$C\bar{H}_3 > R - \bar{C}H_2 > R_2\,\bar{C}H > R3\bar{C}$

(b) Assign E, Z naming to the following compounds :

(i)  and



(ii) Assign R, S notation to be following compounds :

 and 

(c) Explain “Isotope effect’ for determination of reaction mechanism.

(d) Discuss “Resolution of a racemic mixture”.

89. (a) Discuss mechanism of SN2 reaction with an example. Explain the effect of solvent on SN2 reaction.

(b) Draw the Newmann projections of the conformations of n-butane along with the energy profile curve. Write their decreasing order of stability.

(c) Assign the mechanism of the following reactions and write the products of the reactions :

(i) $CH_3 - \underset{\underset{O}{\|}}{C} - H + HCN \xrightarrow{OH^-}$

(ii) $CH_3 - CH = CH_2 +$ Bromine water $\longrightarrow$

(iii) $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - OH +$

Conc. $H_2SO_4 \xrightarrow[170C]{}$

(iv) $(CH_3)_3\ C - Br \xrightarrow{RO}$

Semester- II

Physical Chemistry

Core -IV

Group -A

Each question carries 1 mark.

1. The properties of the system depends upon the state are called_____.

2. In _____ system the energy and matter both are exchanged with surrounding.

3. The system which exchange only energy but not matter called_____.

4.The properties which depends upon the amount of the substance present in the system called _____.

5. Neither matter nor energy exchanged with surrounding called _____.

6. The properties which do not depend upon the amount of the substance present in it called_____.

7. Internal energy is _____ property.

8. Temperature in _____ property.

9. The relationship in between ΔE and ΔH is _____.

10. Surface is _____ property.

11. The relationship in between ΔH and ΔE at isothermal condition is _____.

12. The relationship in between C_p and C_v is_____.

13. The rate of change of internal energy w.r.t. temperature is called_____.

14. The rate of exchange of enthalpy w.r.t temperature at constant process is called_____.

15. In exothermic reaction ΔH is _____

16. If ΔH = +ve, the reaction is _____.

17. Reversible expansion of an ideal gas under isothermal process, the work done is _____.

18. Reversible expansion of an ideal gas under adiabatic process, the work done expression is _____.

19. Kirchhoff's equation at constant pressure is _____.

20. If the strength of bond increases, the bond energy is _____.

21. Kirchhoff's equation Is _____.

22. Resonance energy in terms of bond energy is _____.

23. In spontaneous process, the change in enthalpy is _____.

24. The temperature at which Joule Thomson - co-efficient is zero called _____.

25. Gibb's-Helmholtz equation in terms of free energy is _____.

26. According to 3rd law of TD, the entropy of perfect crystalline substance is _____.

27. Gibb's-Helmholtz equation in terms of work function is _____.

28. For feasibility process, the ΔG = _____.

29. The entropy of the system $CaCO_3 \longrightarrow CaO + CO_{2(g)}$ is _____

30. Entropy change for 'n' mole of gas is _____.

31. Enthalpy change for '1' mole of gas is ----------.

32. Entropy change for irreversible process is _____

33. The relationship between K_p and K_c is _____.

34. The relationship in between K_p and K_x is _____.

35. The relationship in between Kp and Kc for the system $H_{2(g)} + I_{2(g)} \longrightarrow 2HI_{(g)}$ is called _____

36. For this system $N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)}$,if the pressure increases, the equilibrium shifts towards _____.

37. For $N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)}$, ΔH= -ve, If the temperature increases, the equilibrium will shift towards_____.

38. The rate of change of free energy w.r.t composition ,T, P is called _____.

39. The property of the solution which depends upon amount but not nature is called_____.

40. The V.P of solution is _____ than pure solvent.

41. The difference in V.P of solvent and solution is called _____.

42. Raoult's law for non-volatile solute is _____.

43. The boiling point of solution is _____ than pure solvent.

44. The difference in boiling point of solvent and solution is called_____.

45. Colligative property varies _____ of the solute.

46. Freezing point of solvent is _____ than solution.

47. The difference in freezing point of the solvent and solution is called _____

48. At. constant temperature, the osmotic pressure varies _____ with of the solution.

49. The pressure exerted on the solution side to check flow of solvent is called -------.

50. The process in which only solvent flows towards solution side when both are separated by semipermeable membrane is called_____.

Group- B

Each question carries 1.5 marks

(1) Define extensive property?

(2) What is the unit of entropy?

(3) What is the relation between ΔH and ΔU for in reaction

$PCl_5\ (g) \longrightarrow PCl_3\ (g) + Cl_2\ (g)$

(4) What is the effect of temperature on entropy?

(5) What must be the value of ΔG for a spontaneous process?

(6) Define fugacity?

(7) What is the effect of a catalyst on equilibrium?

(8) What is the relation between K_P and K_X?

(9) What is vant-Hoff factor?

(10) Which will boil at a higher temp.? 0.1 (M) Urla or 0.1(M) NaCl or 0.1M $CaCl_2$ under 1 atm pressure.

(11) Give an example of extensive property.

(12) What do you mean by isothermal process?

(13) What must be the value of ΔH, ΔS and ΔG for a process to be spontaneous?

(14) What do you mean by entropy?

15. What is adiabatic flame temperature?

16. State third law of thermodynamics?

17. What is explosion temperature?

18. What is Raoult's law?

19. What is osmotic pressure?

20. What is the relation between entropy change and heat of reaction for a reversible process?

21. Define enthalpy. Give the relation of enthalpy with internal energy.

22. Define heat capacity at constant volume with relation.

23. Define Isothermal condition.

24. Calculate the bond energy of C – H bond in CH_4 which dissociation energy in 398 KJ/mole.

25. State the Second Law of thermodynamics.

26. Define inversion temperature and give the relation to calculate that temperature.

27. Give the expression for calculation of free energy.
28. What is the condition of reaction to be spontaneity.
29. Give Gibbs - Duhem equation.
30. What is colligative property? What are the different colligative properties?
31. Define Raoult's law.
32. Define Le-chatelier's principle.
33. What is the efficiency of carnot cycle.
34. Does efficiency of a machine exceed one?
35. What is an irreversible system give an example?
36. What is the effect of temperature and pressure on K_p of dissociation of HI?
37. What is the value of K_p for the dissociation gaseous $CaCO_3$?
38. What is colligative property?
39. What is Henry's law?
40. Define boiling point.
41. Define freezing point.
42. Define vapour pressure.
43. What is elevation in boiling point.
44. Between sea water and drinking water, which has higher boiling point?
45. What is depression in freezing point.
46. Between tea and drinking water, which has higher freezing point?
47. Between lemon juice and drinking water, which has higher boiling point?
48. Define osmosis.
49. Give the equation of determination of molecular mass of solute by osmotic pressure method.
50. Give the equation of determination of molecular mass of solute by elevation in boiling Point.

Group -C

Each question carries 2.5 marks.

1. State Henry's law and calculate value of Henry's constant K.
2. Write two application of Henry's law?
3. What is ideal solution and non ideal solution? Give one example of each.
4. What are azeotopes? Give two example.
5. Calculate Vapour pressure of a solution containing 0.1 mole glucose in 500 gm of water at 373K.

6. State Boyle's Vant Hoff law and prove πV = constant.

7. State combined Vant Hoff's law and prove that $\pi V = \frac{w}{m}RT$.

8. What is degree of association? Calculate vant Hoff's factor i from it.

9. Explain why

(a) Liquid drops are spherical.

(b) The boiling point of water is more than that of ether.

10. Explain difference between Osmosis and diffasion.

11. Why in chemistry molarity is preferred over molality?

12. Write the main use of Osmotic pressure measurement.

13. Depression in freezing point of 0.01 molal solution of HF is - 0.201^0C. Calculate percentage degree of dissociation of HF (Kf = 1.86kg mol^{-1})

14. Write three factors affecting boiling point of a solution.

15. Write three limitation of Cryoscopic constant.

16. What is Zeroth law of Thermodynamics? Give its mathematical expression.

17. Derive the expression for work of expansion against constant pressure.

18. Derive the relation $\Delta H = \Delta V + \Delta nRT$

19. Derive the relation $C_P - C_V = R$

$C_P = dH/dT$, $C_V = dU/dT$

20. Calculate the pressure volume work performed by the system during reversible isothermal expansion of two moles of an ideal gas from 2 liter to 10 liters at 20^0C.

21. Define heat of hydration and heat up sublimation.

22. Write expression for Gibb's Duhem equation.

23. Under what condition K_P, K_C, K_G and K_X are all equal?

24. Can the equilibrium $CaCO_3(s) \longrightarrow CaO(a) + CO_2(g)$ attached in an open vessel? Why or why not?

25. Give Clausius-Clapeyrin equation for liquid $\rightleftharpoons$ Vapour equilibrium and write its application.

26. Why ΔG^0 obtain from Kp and Kc has different values?

27. Write Vant Hoff's equation. Explain that it lead to the same effect of temperature on equilibrium constant as predicted by Le-chateliers.

28. Write Clausius-Clapeyron equation both in differential form and integrated form.

29. What is Vant Hoff reaction isotherms. Why it is so called.

30. What are Electrolytes? Discuss briefly the classification.

31. Can we have a solution of P^H more than 14 or less than zero?

32. How is the solubility product related to solubility of Ag_2CrO_4?

33. How do you compare the relative strength of weak acids and weak bases?

34. Why the P^H of an aqueous solution of Sodium acetate is more than seven.

35. In the salting out of Sodium stearate, Sodium chloride is added. Explain.

36. Why NH_4Cl is used in Gr III of inorganic analysis?

23. Explain why a solution of $FeCl_3$ in water. Give a brown ppt on standing.

37. Give the reason that an aqueous solution of borax is alkaline.

38. Explain the concept of exchange energy.

39. What is buffer capacity and buffer index?

40. Calculate the pH of a mixture containing 0.01m CH_3COOH and 0.03m Sodium acetate $P^{Ka} = 4.8$

41. Write one application of Le-chatelier principle.

42. How thermodynamic equilibrium constant in terms of activities (K_a) is related to K_p and K_c.

43. What is resonance energy? Give the equation.

44. Differentiate between bond energy and bond dissociation energy.

45. What is residual entropy? Give its concept.

46.Give the concept of fugacity in brief.

47.What is osmotic pressure? Give the equation of mass of solute from this.

48. What is abnormal colligative property? Explain.

49. Give the relation of degree of dissociation for dissociated molecules in solution.

50. State and explain Raoult's law.

Group-D

Each question carries 8 marks.

1. (a) What are heat capacities? Derive a relation between them.

   (b) State and explain the term heat of formation with example.

2 (a) Define adiabatic flame temperature. Derive an expression for this.

(b) Calculate the heat reaction, $H_2 + F_2$ 2HF. Given that the bond enthalpy of H – H, F–F and H-F bonds are 434, 158 and 565 Kg./mole respectively. What are heat capacities? Derive a relation between them.

3. (a) Write the different statements of second law of thermodynamics. What are its important features?

(b) Calculate the entropy change associated with the fusion of 3 mole of ice to liquid water at 273 K. Given that the latent heat of fusion of ice is 80 cal/gm.

4. (a) Derive an expression for calculation of entropy change of one mole of ideal gas considering temperature and volume variables.

   (b) Write notes on residual entropy

5. Write notes on Joule-Thomson coefficient and its relationship with other thermodynamic parameters.

6. (a) Explain Maxwell's relationships

   (b) Write notes on thermodynamic equation of state.

7. (a) Give brief account of equilibrium constants and their quantitative dependence on temperature, pressure and concentration.

(b) Derive thermodynamically the relation between Gibb's free energy and reaction quotient of reaction.

8. Derive thermodynamically the relation between depression in freezing point and the molecular Mass of dissolved solute. .

9. (a) Derive the relation between Vant-Hoff factor and degree of dissociation.

   (b) Derive the boiling point of 10% (w/w) aqueous solution of urea at 1 atm. Pressure. Given that the K_b for water is 0.52K.Kg. $mole^{-1}$

10. State and explain heat capacity at constant volume and at constant pressure. Derive a relation between them. Define heat of reaction, give an example. Calculate ΔH^0 for the reaction:-

CH_4 (g) + $4F_2$ (g) CF_4 (g) + 4HF (g)

Given that the enthalpies of formation of CH_4, CF_4 and HF are -75kJ, -680kJ and -269kJ respectively.

11. State and explain second law of thermodynamics, what was the necessity of second law?

12. Write Notes on :-
    (a) Concepts of residual entropy
    (b) Absolute entropy in liquids
13. What is the significance of Joule-Thomson coefficient and how it is related to other thermodynamic quantities.
14. Write Notes on :-
    (a) Maxwell's relation
    (b) Thermodynamic parameters
15. Derive a relation between Gibbs free energy and reaction quotient thermodynamically.
16. Write Notes on :-
    (a) Le-chatelier's principle
    (b) Equilibrium constants
17. Derive thermodynamic relation between relative lowering of vapour pressure and molecular mass of non-volatile solute. A solution containing 10g. of a non-volatile compound is 100g. of ether has a vapour pressure of 426mm. if the vapour pressure ethen is 442.2mm. Calculate the molecular mass of the solute (mm of ether = 58)
18. Derive a relation between depression in freezing point and molecular mass of non-volatile solute. 5g. of a substance dissolved in 50g. of water lowered the freezing point by 1.2^0C. Calculate the molecular mass of the substance. The molal depression constant of water is 1.85^0C.
19. (a) Prove that for reversible adiabatic change of one mole of ideal gas, PV^r = Constant.
    (b) Show that $C_P - C_V = R$ for 1 mole of ideal gas.
20. (a) Write Notes on bond energy.
    (b) Calculate the bond energy of HCl molecule. Given below are the heats of atomisation H_2 and Cl_2.

$$\frac{1}{2} H_2 (g) \longrightarrow H (g); \Delta H = 52.4\text{Kcal},$$

$$\frac{1}{2} Cl2 (g) \longrightarrow Cl (g); \Delta H = 28.9\text{Kcal},$$

21. (a) Discuss the variation of free energy change with pressure and temperature.
    (b) State and explain third law of thermodynamics.
22. (a) What is meant by residual entropy?
    (b) Deduce the entropy changes of an ideal gas by varying temperature and volume.
23. (a) What are partial molar quantities? Explain.
    (b) Derive Gibbs-Duhem equation.
24. (a) Derive an equation for chemical potential of ideal mixtures.
    (b) Explain change in Thermodynamics functions in mixing of ideal gases.
25. (a) Derive the Law of chemical equilibrium in term of K_P thermodynamically.
    (b) Write note on Le-Chatelier's principle.

26. (a) For a gaseous reaction prove that $\Delta G = \Delta G^0 + RT \ln K_P$

(b) What are coupling of exoergic and endoergic reactions? Explain.

27. (a) Write note on Raoult's law.

(b) Derive thermodynamically the relationship between depression in freezing point and molecular mass of solute.

28. (a) What is Osmotic pressure? How is it related to the molecular mass of solute in dilute solution?

(b) Determine the molecular mass of solute in case of association in solution.