

# MULTIPLE CHOICE QUESTIONS

## M.SC. - II SEMESTER CHEMISTRY

**I<sup>ST</sup> PAPER - INORGANIC CHEMISTRY**  
**II<sup>ND</sup> PAPER - ORGANIC CHEMISTRY**  
**III<sup>RD</sup> PAPER - PHYSICAL CHEMISTRY**  
**IV<sup>TH</sup> PAPER - SPECTROSCOPY AND  
ANALYTICAL METHODS**

**BY-**

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(01)

## Multiple Choice Questions

[MCQs]

Class - M.Sc [2<sup>nd</sup> sem]

Subject - Chemistry

Paper

I<sup>st</sup> Paper - Inorganic Chemistry

attempt all questions and each  
question carry 02 marks

Q1 The full form of CTC

ANS. Charge transfer complex

Q2. Charge transfer complex is also known as

ANS. Electron donor-acceptor complex.

Q3 Charge transfer complex is a

ANS. Association of two or more molecules, in which a  
fraction of electronic charge is transferred between the  
molecular entities.

Q4. What is the example of charge transfer complex?

ANS. Between iodine and starch form an intense  
purple colour

Q5. Charge transfer complex is also a

ANS. Generally have transition energy in visible region  
of the electromagnetic spectrum, so colour is ~~observed~~  
observed.

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(Contd. from Page NO-01)

M. Sc [II-Sem]

1st Paper - Inorganic Chemistry

Q 6. Some common examples due to CTC.  
ANS.  $KMnO_4$ ,  $K_2Cr_2O_7$ ,  $K_2CrO_4$ ,  $CrO_2Cl_2$ ,  $CrO_2F_2$  etc

Q 7. Why is  $KMnO_4$  purple?

ANS. Due to electronic transition

Q 8. Why are transition metals coloured?

ANS. Because they have unpaired or either half filled orbitals

Q 9. What is charge transfer state?

ANS. An excited state [electron from a lower orbit to higher one]

Q 10. What is d-d transition in chemistry?

ANS. An electron in a d-orbital on the metal is excited by a photon to another d-orbital of higher energy

Q 11. What are the three types of charges?

ANS. Charging by friction, charging by contact and charging by induction.

Q 12. What are f-f transition?

ANS. The transition of an electron from an f-orbital which is lower in energy to an f-orbital which is higher in energy.

Q 13. Full form of MLCT

ANS. Metal Ligand charge transfer

PTO

1st Paper - Inorganic Chemistry

Q 14 Five electron systems are found in.
ANS. In cyclic 5-, 6- and 7- membered hydrocarbons.
ligands and non-cyclic ligands

Q 15 - What are ligands in chemistry?
ANS. Ligand is an ion or molecule [functional group]
that binds to a central metal atom to form
coordination complexes.

Q 16 The size of the ligands is.
ANS ligands is indicated by its cone angle.

Q 17. What are the types of ligands?
ANS. Unidentate, Bidentate and tridentate

Q 18. What is polydentate ligand?
ANS. EDTA, a hexadentate ligand, is an example
of a polydentate ligand that has six donor
atoms with electron pair.

Q 19 Examples of common ligands.
ANS. Are the neutral molecules water H2O, NH3,
CO and the ~~various~~ anions cyanide (CN-),

Cl- & OH-
Q 20 Which is strongest ligands?
ANS. Ligands cyanide & CO are strong field-ligands

Q 21 What are the weak ligands?
ANS. Halides are called weak field ligands.

Q 22. How are ligands are classified?
ANS. On the basis of their binding sites with the
central metal atom or ion.



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M. Sc [II-Sem]

1st Paper - Inorganic Chemistry

Q23 Ligands are the.

ANS. Lewis bases.

Q24. The full form of SCO is

ANS. spin crossover.

Q25. spin crossover is also known as.

ANS. spin-transition (or) spin-equilibrium.

Q26. What is spin crossover?

ANS. A concept that occurs in some metal complexes wherein the spin state of the complex change due to an external stimulus.

Q27. Tanabe-Sugano diagram used in.

ANS. In coordination chemistry to predict the absorption in the UV visible & IR electromagnetic spectrum of coordination compounds.

Q28. Full form of CFT.

ANS. Crystal Field Theory

Q29. What is the use of Crystal Field Theory?

ANS. A model for the bonding interaction between transition metals and ligands.

Q30. What is crystal field splitting?

ANS. Is the difference in energy between d-orbitals of ligands.

Q31. Full form of DQ in CFT.

ANS. Differential Quantum

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(Contd. from Page No-04)

M.Sc (II<sup>nd</sup> sem)

Ist paper - Inorganic Chemistry

Q 32. Full form of CFSE.

ANS. Crystal Field Stabilization Energy

Q 33. What are  $\pi$ -acid?

ANS.  $\pi$ -acid ligand is a CO, CO is a good  $\pi$ -acceptor [Lewis acid due to empty  $\pi$ -orbitals & a good sigma donor (Lewis acid)]

Q 34. What are  $\pi$ -acid ligands?

ANS. They have a relatively low-lying LUMO.

Q 35. What are metallic clusters?

ANS. Are a molecular ion or neutral compounds composed of three or more metals.

Q 36. The three forms of ~~carbon~~ carbon.

ANS. Diamond, Graphite, Fullerenes

Q 37. What is the name of C<sub>60</sub> carbon crystal?

ANS. Buckminsterfullerene

Q 38. What are metal carbonyl complexes?

ANS. Are the coordination complexes of transition metals with carbon monoxide ligands.

Q 39. What are the common metal carbonyls?

ANS. It includes tetracarbonyl nickel Ni(CO)<sub>4</sub>, pentacarbonyl iron Fe(CO)<sub>5</sub> and octacarbonyl dicobalt Co<sub>2</sub>(CO)<sub>8</sub>.

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M. Sc [II<sup>nd</sup> Sem]

Ist Paper - Inorganic Chemistry

Q. 40 Is  $H_2$  is ligand?

ANS. Dihydrogen complexes are coordination complexes containing intact  $H_2$  as a ligand.

Q. 41 What is synergic bond?

ANS. The bond between a carbonyl group acting as a ligand and a metal.

Q. 42 How is synergic bond is formed?

ANS. Formed by  $\pi$ -acid ligands like CO.

Q. 43 The 2-electron ligand is.

ANS. Ethylene and all olefinic compounds

Q. 44. What is the 16 and 18 electron rule?

ANS. If the metal's valence shell contains 16 or 18 electrons.

Q. 45 The full form of EAN.

ANS. Effective atomic rule.

Q. 46. What is organo-metallic compounds?

ANS. Those contain at least one carbon-metal bond.

Q. 47 What is  $\pi$ -acceptor?

ANS. An electron acceptor is a chemical entity that accepts electron transferred to it from another compound

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(07)

(Contd. from Page No - 06)

M.Sc [II<sup>nd</sup> - Sem]

Ist Paper - Inorganic Chemistry

- Q 48. What is Zeolites ?  
ANS. Microporous, aluminosilicate mineral, used as a commercial adsorbent and catalyst.
- Q 50. Zeiss salt is also known as.  
ANS. Metal-olefinic compound in organo-metallic compound.
- Q 51. Hapticity and hapticity is a  
ANS. Ligand property.
- Q 52. Ferrocene is also known as  
ANS. Metallocene (or) Sandwich compound.
- Q 53. Synergic effect is also known as  
ANS. synergic bonding in metal carbonyl.
- Q 54. The bonding in metal carbonyl is  
ANS. Back bonding.
- Q 55. Back bonding takes place in  
ANS. In  $BF_3$
- Q 56. The effective atomic number in  $Ni(CO)_4$  is  
ANS. 36
- Q 57. Essential element for thyroid is.  
ANS. Iodine
- Q 58. Element present in Vitamin B<sub>12</sub>  
ANS. Co element.

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Ist Paper - Inorganic Chemistry

Q 59. Ferrocene is used for.

ANS. As precursor to iron nanoparticles can be used as a catalyst for the production of carbon nanotubes.

Q 60. What is the formula of ferrocene?

ANS.  $C_{10}H_{10}Fe$

Q 61. The importance of Zeiss's salt in organo-metallic chemistry.

ANS. Zeiss salt is Potassium trichloro(ethylene) platinate  $K[PtCl_3(C_2H_4)]H_2O$

Q 62. What are the silicates on the earth?

ANS. Quartz, Feldspar, mica, Pyroxene, silicon dioxide,

Q 63. The silicate structure is

ANS. Silicon tetrahedron, Silicon  $[Si^{+4}]$  surrounded by four oxygen atoms.

Q 64. What are the silicates used for?

ANS. Also used to make glass and Ceramics

Q 65. The colour of ultramarine is

ANS. Deep blue colour pigments

Q 66. The chemical formula of Zeolites.

ANS.  $Na_2Al_2Si_2O_8 \cdot xH_2O$

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M.Sc [II-SEM]Ist Paper - Inorganic Chemistry

Q 67. What is Permutt is  
ANS. Man made Zeolites,

Q 68. The function of man made zeolites

ANS. Used to removes the hardness of water because the zeolites contain sodium and Aluminium which makes the water soft in nature.

Q 69. Zeolites is also used for.

ANS. This is made of microporous minerals which have the capacity of exchanging ions.

Q 70. What is polyoxometalate?

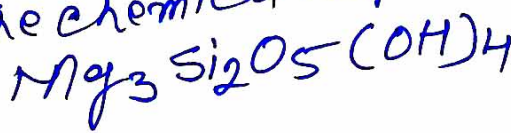
ANS. Are the large metal clusters anions formed mainly by transition metal and oxygen atom.

Q 71. What is asbestos.

ANS. Hydrus magnesium silicate

Q 72. The chemical composition of asbestos [Asbestos]

ANS.



[Asbestos sheet एक  
कारे की उद्योग में  
Factory में हुता के ऊपर  
हलमाल को जाना है  
(ये fire-Resist होती है)]

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Multiple choice Questions  
[MCQs]

Class - M. Sc [II<sup>nd</sup> sem]  
Subject - Chemistry  
II<sup>nd</sup> Paper - Organic Chemistry

attempt all questions and  
each question carry 02 marks

Q 1. What is free radical reactions?  
ANS. Chemical process in which molecules having  
unpaired electrons are involved

Q 2. How many types of free radical reaction  
occurs?

ANS. Three chain steps - (i) chain initiation step  
(ii) chain propagation step (iii) chain termination  
step

Q 3. What is example of Free Radical reactions?

ANS. Halogenation of alkenes

Q 4. What are the two types of radicals?

ANS. (i) Free Radicals with one unpaired electron [C<sup>•</sup>]  
(ii) Free Radical with two unpaired electrons, as  
Carbene.

Q 5. What is the difference between ion and radical?

ANS. An ion carries a charge, while radical has  
an unpaired electron.

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(Contd. from Page 110-01)

M. Sc (II<sup>N</sup>-sem)

II<sup>N</sup> Paper - Organic Chemistry

Q. 6. Why are free Radicals harmful?  
ANS. Free radicals are atoms or molecules, that are highly reactive with other cellular structures because they contain unpaired electrons, they can cause damage cells, as proteins, DNA & cell membranes by stealing their electrons through oxidation process.

Q. 7. What is the difference between radical and free radical?  
ANS. Radicals contain +ve (or) -ve (or) neutral charge. While free Radicals contain unpaired electrons.

Q. 8. Hunsdiecker reaction is also known as.  
ANS. Borodin Reaction

Q. 9. What is Hunsdiecker reaction?  
ANS. The reaction in which the silver salts of carboxylic acid reacts with halogen to produce an organic halide.

Q. 10. The extension of Hunsdiecker reaction.  
ANS. Also called Simonini reaction.

Q. 11. What is Simonini reaction?  
ANS. The synthesis of aliphatic ester from two equivalents of silver carboxylate and one equivalent of iodine.

Q. 12. Why CCl<sub>4</sub> is used in Hunsdiecker reaction?  
ANS. CCl<sub>4</sub> just acts as a solvent for the smooth conduct of the reaction.



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(Contd. from Page No - 02)

M. Sc [I<sup>st</sup> Sem]

I<sup>st</sup> Paper - Organic Chemistry

Q 13. What is Finkelstein reaction?

ANS. An S<sub>N</sub>2 reaction in which one halogen atom [the leaving group] is replaced by another halogen atom [the nucleophile]

Q 14. What is example of Finkelstein Reaction?

ANS. 1-chloro-2-phenylethane (a primary alkyl halide) is treated with sodium iodide (the nucleophile) to produce 1-iodo-2-phenylethane.

Q 15. What is Birnbaum Simonini Reaction?

ANS. For preparing esters by heating a mixture of silver salts of carboxylic acid and iodine.

Q 16. What is Swarts Reaction?

ANS. Used to get alkyl fluorides from alkyl chlorides or alkyl bromides.

Q 17. What is the example of Swarts Reaction?

ANS. By heating of alkyl chloride or alkyl bromide in the presence of the fluoride of some heavy metals [as silver fluoride or mercurous fluoride]

Q 18. CCl<sub>4</sub> is a

ANS. Non-polar organic solvent

Q 19. What are polar solvents?

ANS. Have large dipole moments, they contain bonds between atoms with very different electronegativities, such as oxygen and hydrogen.

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(Contd. from Page No-03)

M. Sc [II<sup>nd</sup>-Sem]

II<sup>nd</sup> Paper - Organic Chemistry

- Q 20. What is Non-polar solvents ?  
ANS. Non-polar solvents contain bonds between atoms with similar electronegativities, such as carbon and hydrogen.
- Q 21. What is the most polar solvent ?  
ANS. Water is called universal solvent, it is most polar solvents with higher dielectric constant and dissolve most of the solute.
- Q 22. What is typical non-polar solvents ?  
ANS. Non-polar solvents are lipophilic, as they dissolve non-polar substances, such as oils, fats, greases.
- Q 23. The common examples of Non-polar solvents.  
ANS.  $CCl_4$  (Carbon tetrachloride),  $C_6H_6$ , Diethylether, Hexane, Methylene chloride.
- Q 24. What are common examples of solvent ?  
ANS. Milk (Solvent) and ~~solute~~ sugar (Solute) makes sweet milk.
- Q 25. What is leaving group ?  
ANS. Is a molecular fragment that departs with a pair of electrons in heterolytic bond cleavage.

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(Contd. from Page No -04)

M.Sc (II<sup>nd</sup>-Sem)

II<sup>nd</sup> Paper - Organic Chemistry

- Q.26. Leaving Group is also known as.  
 Ans. Leaving groups may also be positively charged cations [such as H<sup>+</sup> released] during the nitration of benzene, so also known as "Electrofuges".
- Q.27. Good leaving groups are.  
 Ans. Weak bases, the weaker the base, the better the leaving group.
- Q.28. What is Free Radical substitution?  
 Ans. Is a substitution reactions involving free radicals as an reactive intermediates.
- Q.29. What is affect of substrate in chemistry?  
 Ans. Substrate can affect atomic ordering in the liquid at the interface.
- Q.30. What is the function of a substrate?  
 Ans. A substrate is a molecule upon which an enzyme acts, enzymes catalyzes chemical reactions involving the substrates.
- Q.31. What is the effect of substrate concentration on enzyme activity?  
 Ans. Increasing substrate concentration also increases the rate of reaction to a certain point.

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(06)

(Contd. from Page No-05)

M. SC [II<sup>nd</sup>-Sem]

II<sup>nd</sup> Paper - Organic Chemistry

Q 32. What is Gattermann-Koch reaction?  
ANS. In which carbon monoxide (CO) is used instead of HCN.

Q 33. What is azo coupling reaction?  
ANS. The reaction between a diazonium compound and another aromatic compound, that produces an azo compound.

Q 34. What is azo group?

ANS  $-N=N-$

Q 35. In the presence of  $NaNO_2/HCl$  and temperature between  $0-5^\circ C$ , the reaction is known as.

ANS. Diazotization Reaction

Q 36. What is Regioselectivity?

ANS. The preference of one direction of chemical bond making or breaking over all other possible ~~the~~ directions.

Q 37. Regioselectivity can also be applied.

ANS. To specific reactions such as addition to pi-ligands.

Q 38. Selectivity also occurs in.

ANS. Carbene insertions, for example in the Baeyer-Villiger Reaction.

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(Contd. from Page 110-06)

M. SC [II<sup>nd</sup> Sem]

II<sup>nd</sup> Paper - Organic Chemistry

Q39. What is chemoselectivity?

ANS. A reaction that operates exclusively on one functional group in the presence of other functional group.

Q40. What is Sharpless epoxidation?

ANS. The reaction is an enantioselective chemical reactions to prepare 2,3-epoxyalcohol from primary and secondary allylic alcohols.

Q41. Asymmetric epoxidation is also...

ANS. Also known as Sharpless epoxidation reaction) is a method of preparing chiral epoxides from prochiral allylic alcohols.

Q42. What is epoxidation of alkenes?

ANS. Where an alkene is subjected to a peroxy acid to convert it into an epoxide.

Q43. Why is epoxidation important?

ANS. It is used as fumigant and to make antifreeze, ethylene glycol.

Q44. What is meant by epoxidation?

ANS. Conversion of alkene into an epoxide.

Q45. What types of reagent used in epoxidation?

ANS. Hypochlorous acid, H<sub>2</sub>O<sub>2</sub> and organic peracid.

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(Contd. from Page No -07)

M.Sc [II<sup>nd</sup> Sem]

II<sup>nd</sup> Paper - Organic Chemistry

Q46. Epoxide is a

ANS Cyclic ether.

Q47 Formula of Epoxide.

ANS



Q48 Epoxides is also known as

ANS. Oxiranes

Q49. What is Michael addition?

ANS. Nucleophilic addition of carbanion or another nucleophile to  $\alpha, \beta$ -unsaturated carbonyl compounds

Q50 Which class of Michael Addition?

ANS. Longer class of conjugated addition

Q51 When the  $\alpha, \beta$ -unsaturated compound undergoes Michael addition, it is called as?

ANS. Michael acceptor

Q52

The nucleophile in Michael addition is.

ANS.

Michael donor

Q53

What product in Michael addition is also known as?

ANS.

Michael adduct.

Q54.

What is ylide?

ANS

A molecule having adjacent atoms with opposite formal charge [as, zwitterion]

PTO



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(Contd. from Page 10 - 08)

M.Sc [II<sup>nd</sup> sem]

II<sup>nd</sup> paper - Organic Chemistry

Q 55. How many types of ylides exist &

ANS. Two types - stabilized ylide and unstabilized ylide.

Q 56. What is pericyclic reactions?

ANS. Type of organic reactions wherein the transition state of molecule has a cyclic geometry.

Q 57. Pericyclic reactions are also..

ANS. A pericyclic reaction is one in which bonds are made or broken in a ~~concert~~ concerted cyclic transition state.

Q 58. What is Diophile?

ANS. A compound that easily reacts with diene, especially an alkene in the Diels-Alder reaction.

Q 59. Addition Reaction takes place in

ANS. In alkenes (or) olefinic compounds.

Q 60. How many types of Elimination reactions take place?

ANS.  $\alpha$ -Elimination and  $\beta$ -Elimination.

Q 61. Pericyclic reactions are also.

ANS. Pericyclic reactions are induced either thermally or photochemically, are highly stereospecific reactions.

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(Contd. from Page NO - 09)

M. Sc [II<sup>nd</sup> Sem]

II<sup>nd</sup> Paper - Organic Chemistry

Q. 62. Pericyclic reactions are also classified into -

ANS. Classified into four different classes, as electrocyclic, cycloaddition, sigmatropic rearrangements and group transfer reactions.

Q. 63. Pericyclic reactions usually are.

ANS. Rearrangement reactions.

Q. 64. What is concerted process?

ANS. Is a chemical reactions in which all bond breaking or bond making occurs in a single step [Reactive intermediates or other unstable high energy intermediates are not involved]

Q. 65. What is frontier orbital?

ANS. Refers to the orbitals that are at the outer edges of a molecule. [These are found to be the orbitals that are the most spatially delocalized.]

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[Contd. from Page No -10]

M. SC [II<sup>nd</sup> Sem]

II<sup>nd</sup> Paper - Organic Chemistry

- Q 66. Is  $S_N2$  concerted ?  
ANS.  $S_N2$  reactions are bimolecular in rate of reaction and have a concerted mechanism.  
Q 67. Full form of FMO.  
ANS. Frontier Molecular orbital  
Q 68. What is the important aspects of FMO ?  
ANS. FMO Theory is the focus on the highest ~~occupied~~ occupied and lowest unoccupied molecular orbitals [HOMO and LUMO]  
Q. 69. Polarography is also known as  
ANS. ~~Vol~~ Voltammetry.  
Q 70. What is polarography ?  
ANS. Is an electroanalytical technique that measures the current flowing between two ~~electro~~ electrodes in the solution [In the presence of gradually increasing applied voltage] to determine the concentration of solute.  
Q 71. What is Lelkovic equation ?  
ANS. Is a relation used in polarography relating the diffusion current ( $i_d$ ) and the concentration of the depolarizer ( $C$ ) which is the substance reduced (or) oxidised at dropping Mercury electrode.

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(Contd. from Page No -11)

M. Sc [II<sup>nd</sup> - Sem]

II<sup>nd</sup> Paper - Organic Chemistry

Q.72. The Levich equation is

$$i_d = k n D^{1/3} m^{2/3} t^{1/6} C$$

Q.73. What is Voltammetry?

ANS. It is a technique in which the potential is varied in a regular manner while the current is monitored.

Q.74. Polarography is also

ANS. Subtype of Voltammetry, that utilizes a liquid metal electrode.

Q.75. What is DME?

ANS. Dropping Mercury Electrode.

Q.76. DME is used in.

ANS. A mercury electrode used as working electrode made of mercury in polarography.

Q.77. What are the main applications of Polarography?

ANS. Extensively used to determine trace metals in ~~pharmaceuticals~~ pharmaceutical products and to estimate drugs that contain metals as a constituent.

P.T.O



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M.Sc [II<sup>nd</sup> sem]

- Q 78. What is migration current ?  
ANS. As an additional current produced by electrostatic attraction of cations to the surface of a dropping electrode.
- Q 79. In electrophilic substitution reaction  $\text{NO}_2$  is  
ANS. m-directing
- Q 80. ipso substitution is  
ANS. Electrophilic substitution.
- Q 81. What is Cope rearrangement ?  
ANS. Is an organic reaction where a, 1,5-diene, under thermal condition, is converted to another 1,5-diene structural isomer.
- Q 82. What is Claisen rearrangement ?  
ANS. A powerful carbon-carbon bond forming chemical reaction.
- Q 83. Condensation between active hydrogen and carbonyl ~~compound~~ group.  
ANS. Knoevenagel condensation.
- Q 84. Benzoin condensation is.  
ANS. Is an addition reaction involving two aldehydes or glyoxals.

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Multiple choice Questions

[MCQs]

Class - M.Sc [II<sup>nd</sup> sem]

Subject - Chemistry

III<sup>rd</sup> Paper - Physical Chemistry

Attempt all questions and each question carry 02 marks.

Q.1. What is statistical thermodynamics & ANS. It is a theory that uses molecular properties to predict the behaviour of macroscopic quantities of compounds.

Q.2. What is thermodynamic probability & ANS. The number of possible processes by which the state of a physical system can be realized.

Q.3. The thermodynamic probability is denoted by. ANS.  $\Omega$ .

Q.4. The statistical thermodynamics is also known as. ANS. Equilibrium statistical mechanics.

Q.5. What is the aim of statistical thermodynamics & ANS. To derive the classical thermodynamics of materials in terms of the properties of their constituent particles and interactions between them.

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(Contd. from Page No-01)

M.Sc [II<sup>nd</sup>-sem]

III<sup>rd</sup> paper - Physical chemistry

Q 6. What is thermodynamics example ?  
ANS. Is the branch of physics that studies how ~~heat~~ heat changes to and from other energy forms

Q 7. What is entropy ?  
ANS. Is a measure of the energy dispersal in the system.

Q 8. Example of entropy  
ANS. The solid wood burns and becomes ~~ash~~ ash, smoke and gases.

Q 9. How we calculate entropy ?  
ANS. Is a measure of probability and the molecular disorder of a macroscopic system.

Q 10. The formula of thermodynamics.

ANS  $\Delta U = q + w = 0$  and  $\Delta U = q$   
[The internal energy is equal to the heat of the system]

Q 11. What is Boltzmann constant ?

ANS.  $k_B$  (or)  $k$

Q 12. The Boltzmann constant has.

ANS. Dimension energy divided by temperature, the same as entropy

Q 13. Partition function varies with.

ANS. Directly with temperature

Q 14. Relationship between entropy and probability

ANS  $S = k \log W$

P.T.O

03

(Contd. From Page No -02)

M.Sc [II<sup>nd</sup> sem]

III<sup>rd</sup> Paper - Physical Chemistry

Q 15. The First Law of thermodynamics.

ANS. Law of conservation of energy  
[States that energy can not be created or destroyed in an isolated system]

Q 16. How many types of thermodynamics?

ANS. open, closed and isolated

Q 17. What is the function of open system in thermodynamics?

ANS. An open system can exchange both energy and matter with the surroundings.

Q 18. What is  $c_v$  in thermodynamics?

ANS. Specific heat in constant volume.

Q 19. What is partition function?

ANS. Functions of the thermodynamic state variables such as temperature and volume.

Q 20. The molecular partition function is-

ANS.  $q_v$ , is defined as the sum over the states of  $q$  individual molecules.

Q 21. The full form of T.E.

ANS. Translation energy.

Q 22. The vibrational partition function is

ANS. For a polyatomic molecule for each vibrational normal mode.

PTO



III<sup>rd</sup> Paper - Physical Chemistry

Q.23. What is partition function in chemistry?  
ANS. Statistical properties of a system in thermodynamic equilibrium.

Q.24. What is non-equilibrium thermodynamics?  
ANS. Concerned with transport processes and with the rates of chemical reactions.

Q.25. Nylon (6-6) is a  
ANS. Condensation polymer

Q.26. What is HDPE in chemistry?  
ANS. High-density polyethylene.

Q.27. HDPE is  
ANS. Thermoplastic polymer

Q.28. What is PMMA?  
ANS. Poly methyl methacrylate.

Q.29. PMMA is also known as  
ANS. Acrylic, acrylic glass or plexiglass  
[Trade name is crylux, Lucite, Astriglass]

Q.30. PMMA is used in  
ANS. A transparent, rigid plastic, used as substitute for glass such as shatterproof windows, aircrafts canopies, skylights, and illuminated signs

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(Contd. from Page 110 - 04)

M.Sc [II<sup>nd</sup> sem]

III<sup>rd</sup> Paper - Physical Chemistry

Q 31. What is entropy production?

ANS. Is the amount of entropy which is produced in any irreversible processes such as heat

or mass.

Q 32. What is concept of entropy?

ANS. The measure of a system's thermal energy per unit temperature.

Q 33. Full form of E<sub>n</sub>B<sub>E</sub>.

ANS. Entropy balance equation.

Q 34. What is entropy balance?

ANS. Is an expression of the second law of thermodynamics.

Q 35. Onsager equation is.

ANS. Electrical conductivity.

Q 36. The Debye Huckel Onsager equation is.

ANS.  $\Lambda_m = \Lambda_0 m - (A + B\Lambda_0 m) \sqrt{c}$

[where A and B are constant that depends only on known quantities such as temperature, the charge on ions & the dielectric constant & the viscosity of the solvent]

Q 37. What is full form of DHO?

ANS. Debye-Huckel-Onsager

(PTO)



(06)

(Contd. from Page No - 05)

M. Sc [II<sup>nd</sup> - Sem]

III<sup>rd</sup> Paper - Physical Chemistry

Q 38. What is exchange carrier density in chemistry?  
ANS. Is a parameter used in Tafel equation, Butler-Volmer equation & other electrochemical kinetics expressions.

Q 39. What is charge density?  
ANS. The ratio of the charge of an ion to its volume.

Q 40. What is electrochemistry?  
ANS. Branch of chemistry deals with the relations between electrical and chemical concepts.

Q 41. Electrochemistry is also -  
ANS. The chemical processes that cause electrons to move.

Q 42. How many types of electrochemical cells?  
ANS. Voltaic cell and Electrolytic Galvanic cells.

Q 43. What is polymerization kinetics?  
ANS. Is the process of reacting monomer molecules together in a chemical reaction to form three dimensional networks or polymer chains.

Q 44. What is ~~Lekovic~~ Lelkovic equation?  
ANS. Is a relation used in polarography [concern with the diffusion current and the concentration of the depolarizer].

PTO

(07)

(Contd. from Page No - 06)

M.Sc [II<sup>nd</sup>-Sem]

III<sup>rd</sup> Paper - Physical Chemistry

Q45. What are the half cell potential & ANIS The potential developed at the electrode of each half cell in an electrochemical cell.

Q46. Why KCl is used in salt bridge & ANIS Because it provides ~~high~~ <sup>high</sup> positive K<sup>+</sup> ions and negative Cl<sup>-</sup> ions as the salt bridge needs to maintain the neutrality in the systems by providing enough -ve ions equal to the +ve ions during oxidation.

Q47. What is Butler-Volmer equation & ANIS It is one of the most fundamental relationship in electrochemical kinetics.

Q48. The Butler-Volmer equation is also known as -

ANIS. Tafel - Gruz - Volmer equation

Q49. What is the concept of Butler-Volmer equation & ANIS The development of a prediction of an activation polarization for a particular current density

Q50. What is Tafel plot equation &

ANIS It is an equation in electrochemical kinetics relating the rate of an electrochemical reaction to the overpotential.

P.T.O



(08)

(Contd. from Page No -07)

M.Sc [II<sup>nd</sup> Sem]

III<sup>rd</sup> Paper - Physical Chemistry

Q 51. The exchange current density is also obtained by.

ANS. Tafel Plot.

Q 52. What is ECORR?

ANS. The potential at which the rate of oxidation is exactly equal to the rate of reduction.

Q 53. Which macromolecules are polymer?

ANS. Monomers and polymers [Carbohydrates, nucleic acid, proteins are often found as long polymer]

Q 54. What are common examples of macromolecules?

ANS. Proteins, DNA, RNA, plastics are all macromolecules

Q 55. What is carbon nanotubes?

ANS. Are an example of macromolecules, that is not a biological materials.

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(01)

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Multiple Choice Questions

[MCQs]

Class - M. Sc [II<sup>nd</sup> sem]

Subject - Chemistry

IV<sup>th</sup>

[4th]

Paper - Spectroscopy and Analytical Methods

Attempt all questions and each question carry 02 marks.

Q1. What is thermal analysis?

ANS. A branch of materials science where the properties of materials are studied as they change with temperature.

Q2. What is full form of TGA?

ANS. Thermogravimetric analysis

Q3. How does TGA measure?

ANS. Measures the amount of weight change of a material, either as a function of increasing temperature.

Q4. Full form of DTA.

ANS. Differential Thermal Analysis

Q5. What is DSC?

ANS. Differential scanning calorimetry.

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(02)

(Contd. from Page No - 01)

M.Sc [II<sup>nd</sup> - sem]

4th Paper — Spectroscopy and Analytical Methods

Q 6. The basic principle of TGA.

ANS. Is that as a sample is heated, its mass changes.

Q 7. Why is TGA used?

ANS. Is used in determining purity, composition of materials, drying and ignition temperature of materials.

Q 8. Why is DTA is used?

ANS. To determine temperature of transitions, reactions and melting points of substances.

Q 9. Full form of XRD.

ANS. X-ray diffraction.

Q 10. What is XRD concept?

ANS. Is a laboratory based technique commonly used for identification of crystalline materials and analysis of unit cell dimensions.

Q 11. What is vibronic coupling?

ANS. Amplitude of electronic dipole moment coupling vibrations.

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(03)

(Contd. from Page No - 02)

M. Sc [ II<sup>nd</sup> sem ]

4<sup>th</sup> Paper - Spectroscopy and Analytical Methods  
IV

Q12. ESR is a

ANS. Electron spin Resonance spectroscopy.

Q13. ESR is also known as

ANS. Electron Paramagnetic Resonance spectroscopy.

Q14. Full form of TMS.

ANS. Tetra methyl silane

Q15. Is TMS is good leaving group?

ANS. Used as protecting and leaving group for the synthesis of siloxane based ~~more~~ molecules.

Q16. Why is TMS is used?

ANS. Because of its high volatility.

Q17. What is the full form of  $I$  &  $N$ ?

ANS. Nuclear spin quantum number.

Q18. In  $^1\text{H}$ NMR spectrum consist of a ---

ANS. Singlet

Q19. What does  $^1\text{H}$ NMR tells about.

ANS. Proton nucleus magnetic resonance [ Proton NMR ]  
 $^1\text{H}$ -NMR or  $^1\text{H}$ NMR

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(04)

(Contd. 8mm Page No - 03)

M.Sc (II<sup>nd</sup> Sem)

4<sup>th</sup> Paper - Spectroscopy and Analytical Methods  
IV<sup>th</sup>

Q20 What is n<sup>1</sup> rule?

ANS. Empirical rule, used to predict the multiplicity and conjugation with Pascal's triangle.

Q21 What is a nuclear spin?

ANS. Total angular momentum of a nucleus with symbol I.

Q22 What is nuclear g factor?

ANS. Also called g value (or) dimensionless magnetic moment.

Q23 The nature of TMS is

ANS. Quite Volatile

Q24. Is Carbon-13 stable (or) unstable?

ANS. Carbon-12 and Carbon-13 are stable.

Q25. Which solvent is used in NMR?

ANS. C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>, CH<sub>3</sub>OH, DMSO

Q26. How many signals are there in <sup>13</sup>C NMR?

ANS. 23 different signals.

Q27 Full form of DMSO

ANS. Dimethyl Sulphoxide

Q28 Why is Carbon-12 NMR inactive?

ANS. Carbon-12 atoms do not have a nuclear spin.

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(05)

(Contd. from Page No -04)

M. Sc [I<sup>st</sup> Sem]

4<sup>th</sup> Paper  
IV<sup>th</sup> - Spectroscopy and Analytical Methods

Q29. Is DMSO acidic or basic?

ANS. Weakly acidic.

Q30. What is the chemical shift in NMR?

ANS. It is a Resonant frequency of a nucleus and structure of molecules.

Q31. Full form of 2D NMR

ANS. 2-Dimension Nuclear Magnetic Resonance

Q32. What is <sup>19</sup>F-NMR?

ANS. Fluorine is a sensitive nucleus which yields sharp signals and has wide chemical shift.

Q33. What are the main applications of <sup>19</sup>F-NMR?

ANS. Metabolism of 5-Fluorouracil in the liver of patients undergoing chemotherapy.

Q34. What are the main applications of 2D-NMR?

ANS. 2D-NMR provides more information about a molecule, than one dimensional NMR.

Q35. Full form of COSY.

ANS. Correlation spectroscopy

Q36. Full form of DEPT.

ANS. Distortionless enhancement by Polarization Transfer.

(PTO)



(06)

(Contd. from Page NO - 05)

M.Sc [II<sup>nd</sup> sem]

4th Paper - Spectroscopy and Analytical Methods

Q 37. What are the main applications of DEPT NMR & ANS. used for the determining the presence of Primary, Secondary and Tertiary carbon atoms and signals for quaternary carbon atoms.

Q 38. Full form of NOESY.

ANS. Nuclear Overhauser Effect spectroscopy

Q 39. What is EXSY &

ANS. J-spectroscopy exchange spectroscopy.

Q 40. What is the full form of MRI &

ANS. Magnetic Resonance Imaging

Q 41. What is plasma-oscillations &

ANS. Langmuir waves.

Q 42. NMR is a concept of.

ANS. It is a methods of physical observation concept

Q 43. Why is NMR is used &

ANS. In analytical chemistry for quality-control and determining the molecule structure.

Q 44. Excellent example of NMR

ANS. MRI (Magnetic Resonance Imaging)

Q 45. What is meant by resonance in NMR &

ANS. In nuclear system the Larmor (Resonance) frequency

(PTO)

(07)

(Contd. from Page 16-06)

M.Sc [I<sup>st</sup> Sem]

4<sup>th</sup> Paper - Spectroscopy and Analytical Methods

- Q 46. Which is better a CT scans (or) MRI ?  
ANS. CT scans use X-rays, while MRI scans use strong magnets and Radio waves.
- Q 47. What is mass spectrometry ?  
ANS. Analytical techniques that measures mass to charge ratio of ions.
- Q 48. What is the mass spectrometer ?  
ANS. Produces the charged particles [ions] from chemical substances.
- Q 49. What is the basic principle of mass spectroscopy ?  
ANS. To generate ions from either in organic or inorganic compounds.
- Q 50. Full form of AMS in mass spectroscopy.  
ANS. Accelerator Mass Spectroscopy.
- Q 51. Full form of ICP-MS.  
ANS. Inductively coupled plasma-mass spectroscopy.
- Q 52. Full form of IRMS.  
ANS. Isotopic Ratio of Mass Spectroscopy.
- Q 53. Full form of IMS.  
ANS. Ion mobility Spectrometer.

P70



(08)

(Contd. from Page No-07)

M. Sc [II<sup>nd</sup> sem]

4<sup>th</sup>  
IV Paper - Spectroscopy and Analytical Methods

Q 54. How does mass spectrometer identify the compounds?

ANS. Due to different peaks on mass spectrum.

Q 55. What are four stages in mass spectroscopy?

ANS. Ionisation, ~~ionisation~~ Acceleration, Deflection and Detector.

Q 56. The symbol of mass to charge ratio of ions.

ANS.  $m/z$

Q 57. What are main applications of mass spectroscopy?

ANS. To identify the structure of complex biological molecules such as carbohydrates, proteins and nucleic acids.

Q 58. What is  $m/z$  in mass spectroscopy?

ANS.  $m$  stands for mass &  $z$  stands for charge number of ions.

Q 59. Mass spectroscopy requires low or high vacuum?

ANS. Requires high vacuum.

Q 60. Mass is usually measured in

ANS. In grams (g) (or) kilograms (kg)

PTO

(09)

(Contd. From Page No-08)

M.Sc [II<sup>nd</sup> Sem]

4<sup>th</sup> Paper - Spectroscopy and Analytical Methods  
(IV<sup>th</sup>)

Q 61. What is LC-MS?

ANS. Liquid chromatography - Mass spectroscopy.

Q 62. What is GC-MS?

ANS. Gas chromatography - Mass spectroscopy.

Q 63. The mass accuracy is

ANS. Linear in trap [50 - 200 ppm]

Q 64. What is mass fragmentation in mass spectroscopy?

ANS. The dissociation of energetically unstable molecular ions.

Q 65. In mass spectrometer, how many types of ions formed?

ANS. Few 2 ions are formed in mass spectroscopy.

Q 66. What are the major components of a mass spectrometer?

ANS. An ionic source, a mass analyzer and a detector.

Q 67. According to medical terminology, mass is

ANS. Lump [abnormal growth of cells, cyst also]

Q 68. How the mass spectroscopy is used in crime?

ANS. With the help of mass spectroscopy, used in crime forensic science.

PTO



4th Paper - Spectroscopy and Analytical methods  
(IV)

Q 69. What is potentiometry?

ANS. The potential between two electrodes, (is measured while the electric current (usually nearly zero) between the electrodes is

Controlled  
Q 70. Principle of potentiometry.

ANS. When the pair of electrode is placed in the sample solution. E.g. shows the potential difference by the addition of titrant or change in the concentration of ions.

Q 71. Why potentiometric titration is used?

ANS. To find out electrical potential changes, where a neutralising agent is added to a solution.

Q 72. What are the applications of potentiometry?

ANS. Regularly used in environmental analysis, such as in a water treatment plant to monitor nitrate level.

Q 73. What are four types of titrations in chemistry?

ANS. Acid-base titration, Redox titration, Precipitation titration & complexometric titration.

4<sup>th</sup> paper - Spectroscopy and Analytical Methods  
(11<sup>th</sup>)

Q 74. What is Voltametry in chemistry?  
ANS. Electroanalytical methods used in analytical chemistry

Q 75. Voltametry also gives information about.  
ANS. Gives information about an analyte is obtained by measuring the current as the potential is varied.

Q 76. Voltametry is also  
ANS. The study of current as a function of applied potential [These curves  $I = f(E)$  are called "Voltammograms"]

Q 77. What is conductometry?  
ANS. Applied to determine the total conductance of a solution or to analyze the end point of titration that include ions.

Q 78. What is the basic principle of conductometry?  
ANS. According to conductometry, the theory states that anions and cations have different conductance values.

Q 78-A - Full form of FES.  
ANS. Flame emission spectroscopy

Q 78-B. What do you understand by Flame emission spectroscopy?  
ANS. Is a classical method, which has been largely displaced by plasma-spectroscopies.

PTO



(Contd. from Page 10-11)

M. Sc (II<sup>nd</sup> Sem)

4<sup>th</sup> Paper - Spectroscopy and Analytical Methods

Q 79. Which electrode is used in conductometry?

ANS. Platinum is generally used as an electrode material, smooth/shiny electrodes should only be used for conductivities.

Q 80. Why is conductometry often applied to determine the end point of titration that include ions?

ANS. Conductometry is often applied to determine the total conductance of a solution or to analyze the end point of titration that include ions.

Q 81. What is the advantage of conductometric titration?

ANS. Can be used where there is no suitable indicator, this titration is also used with coloured or turbid solutions, in which end point can not be seen by naked eyes.

Q 82. Why KCl is used in conductometry?

ANS. KCl is used for calibration of conductivity meter, because it is very stable.

Q 83. What is pH-metry?

ANS. A instrument that measure the hydrogen-ion activity (or) concentration in water based solutions indicating its acidity or basicity.

Q 84. Full form of pH.

ANS. Potential of hydrogen.

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Q 85. Full form of FAES Spectroscopy

ANS. Flame atomic emission spectroscopy