

Question Bank (Sem-VI) Chemistry

Q1. A) Fill in the blanks:

- 1) As the charge on central metal ion increases, the stability of the complex _____.
- 2) Energy associated with each quantum or photon is proportional to _____.
- 3) Highest energy is required for _____ transition in UV spectroscopy.
- 4) Saturated calomel electrode is commonly used as _____.
- 5) The geometry of $\text{Fe}(\text{CN})_6$ is _____.
- 6) The central metal ion present in haemoglobin is _____.
- 7) $\text{CH}_3\text{CH}_2\text{OH}$ shows _____ NMR signals in NMR spectrum.
- 8) $-\log_{10} [\text{H}^+]$ is known as _____.
- 9) According to quantum theory, the radiations consist of packets of energy called _____.
- 10) The range of fingerprint region is _____.
- 11) The elements which are absolutely necessary for life process in a very small amount are called as _____.
- 12) The complexes showing reaction within one minute, 1M concentration and at room temperature are called as _____ complexes.
- 13) In the nickel carbonyl, the oxidation state of nickel is _____.
- 14) The peak corresponding to the most abundant ion in the mass spectrum of a compound is called _____.
- 15) The angular part of p-orbitals depends on zenith angle (θ) and _____.
- 16) Electrochemistry is the branch of chemistry which deals with the interconversion of chemical energy and _____.
- 17) The complexes in which substitution of one ligand by another takes place rapidly are called as _____ complexes.
- 18) The stretching and _____ vibrations are the functional fundamental modes of vibrations.
- 19) Uncertainty principle is significant only for _____ particle.
- 20) Nuclear reactions accompanied by the absorption of energy are known as _____ reactions.

Q1. B) Select the correct alternative:

- 1) What is oxidation state of iron in haemoglobin and myoglobin respectively?
a) 3, 2 b) 2, 2 c) 2, 3 d) 3, 3
- 2) Which of the compounds is taken as standard for recording chemical shift?
a) Dimethylsilane b) Trimethylsilane
c) Tetramethylsilane d) Methylsilane

3) The nuclear reaction is balanced in terms of _____

- a) Mass only
- b) Mass and energy
- c) No. of atoms
- d) None of the above.

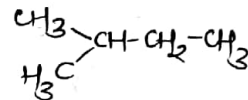
4) Disorder of thyroid glands can be detected by using:

- a) ^{60}Co
- b) ^{24}Na
- c) ^{32}P
- d) ^{131}I

5) Heme is a porphyrin complex of

- a) Fe (II)
- b) Fe (III)
- c) Mg (II)
- d) Zn (II)

6) How many NMR signals would be given by the compound



- a) 3
- b) 4
- c) 5
- d) 2

7) Classical mechanics does not provide satisfactory explanation for:

- a) Black body radiation
- b) Photoelectric effect
- c) Heat capacity of solid
- d) All of the above.

8) Increase in the intensity of absorption in UV-visible spectrum is called:

- a) Hypsochromic shift
- b) Bathochromic shift
- c) Hyperchromic shift
- d) Hypochromic shift

9) The intermediate formed in $\text{S}_\text{N}2$ mechanism shows _____ geometry.

- a) Pentagonal
- b) Trigonal
- c) Octahedral
- d) Pentagonal bipyramidal

10) Expression for energy of a particle in one dimensional box is:

- a) $\frac{n^2 h^2}{8ma^2}$
- b) $\frac{nh^2}{2ma^2}$
- c) $\frac{n^2 h^2}{4ma^2}$
- d) $\frac{n^2 h}{2ma^2}$

11) Number of NMR signals in propane is -

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

12) Geometrical shape of $\text{Cr}(\text{CO})_6$ molecule is:

- a) Linear
- b) Octahedral
- c) Tetrahedral
- d) Pentagonal bipyramidal

13) CH_4 molecule shows _____ electronic transition.

- a) $\sigma \rightarrow \sigma^*$
- b) $n \rightarrow \sigma^*$
- c) $\pi \rightarrow \pi^*$
- d) $n \rightarrow \pi^*$

14) Energy change associated with a nuclear reaction is defined as _____ value of that reaction.

- a) Q
- b) R
- c) Electroniz
- d) E

- 15) The emission of electron from metal surface when light of suitable wavelength falls on it is known as _____ effect.
- a) Photoelectric effect b) Compton effect
c) Threshold frequency d) None of the above
- 16) In muscles myoglobin has _____ oxygen storing capacity than hemoglobin.
- a) more b) less
c) Equal d) None of the above
- 17) Which of the following spectroscopy would determine molecular weight of a compound?
- a) UV-visible b) NMR
c) IR d) Mass spectrometry
- 18) Which of the following would not give singlet signal in NMR?
- a) CH_3CH_3 b) $\text{CH}_3-\text{O}-\text{CH}_3$
c) CH_3COCH_3 d) $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$
- 19) Effective atomic number of Ni in $\text{Ni}(\text{CO})_4$ is.
- a) 36 b) 54
c) 86 d) 53
- 20) A nuclear reaction in which two or more lighter nuclei fuse together to form a heavier nucleus is called as:
- a) Nuclear fusion reaction b) Nuclear fusion reaction.
c) Thermonuclear reaction d) Nuclear reaction

Q1. c) Answer in one sentence:

- 1) Define organometallic compounds.
- 2) What is coupling constant?
- 3) Define hypsochromic shift.
- 4) What is endoergic reaction?
- 5) Define reaction yield.
- 6) Define chromatography.
- 7) Give the range of fingerprint region in IR spectroscopy.
- 8) What is base peak?
- 9) Define the term auxochrome.
- 10) What are phosphonitrilic polymers?
- 11) What is Compton effect?
- 12) What is potentiometric titration?
- 13) What is paper chromatography?
- 14) What is chemical shift?
- 15) What are magic numbers?
- 16) What is threshold frequency?
- 17) Define the R_f value.
- 18) Define the term chromosphere.

Q.2. & Q.3. Unit - I

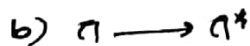
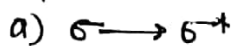
- 1) Discuss the mechanism of substitution reaction in square planar complexes by solvent as a nucleophile.
- 2) Give the conditions for validity of Beer's law.
- 3) What is paper chromatography? Describe the technique of ascending paper chromatography.
- 4) How does nature of central metal ion affect the stability of complexes?
- 5) Differentiate between colorimeter and spectrophotometer.
- 6) How will you determine the amount of copper in given solution by colorimetry?
- 7) Explain the nature of ligands affecting the stability of complexes.
- 8) Draw the block diagram of spectrophotometer and explain its working.
- 9) What is chromatography? Explain the process of descending paper chromatography?
- 10) Explain the term labile and inert complexes with examples.
- 11) Explain SN^2 dissociative mechanism for octahedral complexes.
- 12) What is R_f value? What are the factors affecting it?
- 13) Describe the procedure of colorimetric determination of conc. of Cu^{2+} ions.
- 14) Explain SN^1 -dissociative mechanism of substitution in octahedral complexes.
- 15) Describe the what is Lambert-Beer's law? Write its mathematical expression and limitations.
- 16) What is paper chromatography? Write its applications.
- 17) What are labile and inert complexes? How does charge on metal ion affect the stability of complexes?
- 18) Give the statement of Beer's law. What are its limitations?
- 19) Distinguish between ascending and descending paper chromatography.
- 20) Explain the following terms: i) λ_{max} ii) Calibration curve.
- 21) Illustrate the principle of differential migration of ions in paper chromatography.
- 22) How does charge and size of central metal ion affect the lability of complexes?
- 23) Differentiate between colorimeter and spectrophotometer.
- 24) Draw the block diagram of colorimeter and explain its components in brief.
- 25) How Cu^{2+} ion concentration is determined colorimetrically?

Q. 4. and Q. 5. Unit - II

1. Discuss the role of hemoglobin and myoglobin in oxygen transport process.
2. What are silicones? Give preparation of linear silicone polymer.
3. Give method of preparation of $\text{Cr}(\text{CO})_6$. Explain its structure.
4. Explain how organometallic compounds are classified.
5. What happens when $(\text{PNC}_2)_3$ react with 1) Ammonia, 2) methanol in presence of pyridine?
6. Explain the role of Mg^{2+} in biological process. What are its toxic effects?
7. What are metal carbonyls? Explain the v.B. structure of $\text{Cr}(\text{CO})_6$.
8. Give the application of silicone polymers.
9. Explain the role of Mg^{2+} ions in metabolic activity.
10. Give evidences in support of multiple nature of M-C bond in metal carbonyls.
11. Explain the structure of $(\text{PNC}_2)_3$.
12. Explain the structure of $\text{Fe}(\text{CO})_5$ molecule on the basis of VBT.
13. How is phosphonitrilic chloride prepared from PCl_5 and NH_4Cl ? Give its reaction with ammonia.
14. Explain the role of K^+ in biological activities.
15. What is the action of following on $\text{Ni}(\text{CO})_4$: 1) Halogen & 2) H_2SO_4 ?
16. What happens when $(\text{PNC}_2)_3$ reacts with:
a) alcohol b) C_6H_6
17. Discuss the role of Ca^{2+} in metabolic activity.
18. Explain the structure of $\text{Ni}(\text{CO})_4$ on the basis of hybridization.
19. What are inorganic polymers? Give their classification on the basis of types of reactions.
20. Explain the nature of metal-carbon bond in carbonyls.
21. What are the action of following on $\text{Fe}(\text{CO})_5$ - 1) heat & 2) HCl .
22. Explain the structure of chromium hexacarbonyl on the basis of hybridization.
23. What is the action of following on $\text{Ni}(\text{CO})_4$:
1) Heat 2) H_2SO_4
24. What are phosphonitrilic halide polymers? Write any three applications.

Q. 6. and Q.7. Unit - III

1. Explain the following electronic transitions with suitable examples:



2. Calculate the number of fundamental modes of vibrations for the following molecules:

- i) Water ii) CO_2 iii) NH_3 iv) Benzene.

3. Differentiate the following pairs of compounds on the basis of IR spectroscopy:

- i) Acetone and ethanol ii) Acetamide and acetic acid.

4. What type of electronic transitions do you expect in each of the following?

- i) CH_3-CH_3 ii) CH_3-Cl iii) $\text{CH}_3-\text{CH}_2-\text{NH}_2$ iv) $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$

5. Define the terms with suitable example:

- i) Bathochromic shift ii) Hypochromic shift.

6. In which region IR, absorption bands of stretching vibrations occurs for the following functional groups?

- i) $-\text{C}=\text{O}$ ii) $-\text{N}-\text{H}$ iii) $-\text{C}-\text{H}$ iv) $-\text{C}=\text{C}-$

7. Illustrate with diagram the different types of bending vibrations.

8. Explain the different types of electronic transition that occur in UV-region with suitable diagram.

9. Define the terms with suitable example:

- i) Auxochrome ii) Hypsochromic shift.

10. Differentiate the acetaldehyde and acetone on the basis of IR spectroscopy.

11. What types of electronic transitions do you expect in each of the following?

- i) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ ii) CH_3Cl iii) $\text{CH}_3\text{CH}_2\text{CH}_3$ iv) $\text{CH}_3\text{CH}_2\text{Br}$

12. Arrange the following compounds in the increasing order of their λ_{max} values. Give reasons.

- i) Cyclohexatriene ii) Cyclohexane iii) 1,3-cyclohexadiene.

13. Explain the following electronic transitions with suitable example.

- i) $\pi \rightarrow \pi^*$ ii) $n \rightarrow \sigma^*$

14. Explain the following terms with diagram:

- i) Scissoring ii) Twisting.

15. Explain the following terms:

- i) Hypsochromic shift ii) Hyperchromic effect.

16. What types of electronic transitions do you expect in each of the following compounds?

- i) CH_4 ii) $\text{CH}_2=\text{CH}_2$ iii) CH_3-Cl iv) CH_3CHO

17. Describe types of vibrational modes in IR spectroscopy.
18. What types of vibrational modes are expected in H_2O molecule? Discuss its spectrum.
19. Differentiate between following pairs on the basis of IR spectroscopy.
- CH_3CH_2Br and CH_3CH_2OH
 - CH_3COCH_3 and CH_3CONH_2
20. Identify the types of transitions in each of the following:
- $CH_2=CH-Cl$
 - CH_3NH_2
 - $HC\equiv CH$
 - $CH_3CH_2CH_3$
21. Calculate the number of vibrational modes in CO_2 . Discuss it on the basis of IR spectrum.
22. Define the following terms:
- Finger print regions
 - Blue shift.
23. Which of the following vibrational modes are IR active or inactive?
- Symmetric CO_2 stretching
 - Antisymmetric CO_2 stretching
 - Symmetric H_2O stretching
 - H_2O bending.
24. Distinguish the following molecule on the basis of UV spectroscopy: Ethene and 1,3-butadiene.
25. Explain following:
- Hypsochromic effect
 - Aromatic region in IR spectroscopy.

Q. 8. and Q. 9. Unit - IV

1. Give the ideal relative intensities; ratio for:

i) a triplet ii) a quartet iii) a quintet iv) a doublet.

2. Why is TMS selected as an internal standard reference in NMR spectroscopy?

3. Discuss the fragmentation of acetone.

4. How will you distinguish following pairs by their NMR spectra?

i) CH_3COCH_3 and CH_3COOH ; ii) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$ and $\text{CH}_3\text{CHBrCH}_3$

5. Give the structure of a compound $\text{C}_2\text{H}_6\text{O}$, whose mass spectrum shows m/z values of 15, 29, 31 and 46.

6. Explain the following terms:

i) Base peak ii) shielding effect.

7. Explain the terms:

i) Spin-spin splitting ii) Equivalent and nonequivalent protons.

8. Describe mass spectrum of neopentane.

9. How many signals are observed in NMR spectrum of the following molecules under low resolution:

i) $\text{CH}_3\text{-O-CH}_2\text{-CH}_3$

ii) 

10. Explain the terms:

i) metastable peak

ii) Coupling constant (J-value)

11. Calculate m/e values for the following ions:

i) $[\text{C}_6\text{H}_5]^+$

ii) $[\text{CH}_3\text{COOH}]^+$

12. Differentiate the following pairs on the basis of NMR:

i) CH_3CHO and $\text{CH}_3\text{CH}_2\text{COOH}$

ii) $\text{CH}_3\text{CH}_2\text{NH}_2$ and CH_3CONH_2

13. How will you distinguish following pairs by their NMR spectra:

i) CH_3COCH_3 and CH_3CHO

ii) CH_3OCH_3 and $\text{CH}_3\text{CH}_2\text{-OH}$

13. Calculate m/z value of each of the following in Mass Spectroscopy:

i) $[(\text{CH}_2)_2\text{CH}]^+$

ii) $[\text{CH}_3\text{-NH}_2]^+$

14. Explain in brief the principle of mass spectroscopy.

15. Write the NMR signals shown by following compounds:

i) Ethyl bromide

ii) 1, 3-dichloropropane

iii) Ethyl acetate

iv) Isopropyl bromide.

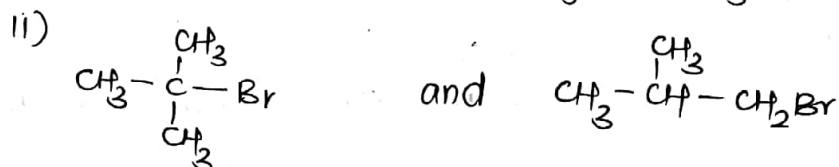
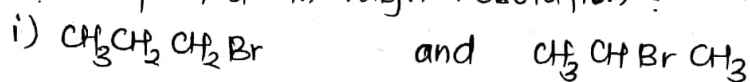
16. Calculate m/z values for each of the following molecular ions:

i) $[\text{C}_6\text{H}_5\text{-CH}_3]^+$

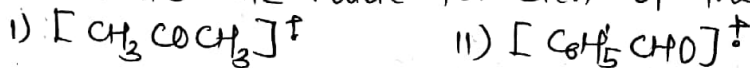
ii) $[\text{CH}_3\text{-CH}_2\text{-OH}]^+$

17. Explain equivalent and non-equivalent protons with suitable example.

18. How will you distinguish the following pairs of compounds by NMR spectra in high resolution?

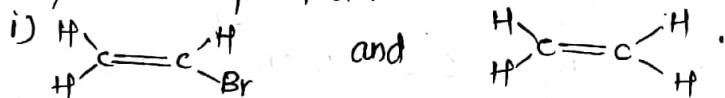


19. Calculate m/z value for each of the following:



20. How many peaks are observed in high resolution NMR spectra for methyl ethyl ether ($\text{CH}_3\text{-O-CH}_2\text{-CH}_3$).

21. How will you distinguish the following pairs of compounds by NMR spectra?



22. Give the number of NMR signals shown by following compounds:

i) Ethyl acetate

ii) 1,3-dichloropropane

iii) Isobutane

iv) Cyclobutane

23. Explain the terms:

i) Fragmentation

ii) Molecular ion.

24. Predict the multiplicities of the signals in the proton NMR spectra of the following:

i) Ethyl bromide

ii) Isopropyl bromide.

Q.10 and Q.11. Unit - V

1. Explain the postulates of Planck's quantum theory of radiation.
2. What do you understand by dual character of matter? Derive the de-Broglie's equation.
3. Derive an expression for the energy of a particle in one dimensional box.
4. state and explain photoelectric effect.
5. Differentiate between classical mechanics and quantum mechanics.
6. Explain the physical significance of ψ and ψ^2 .
7. state and explain Heisenberg's uncertainty principle.
8. state and explain Compton's effect.
9. What is the ground state energy of an electron in one dimensional box of width 1.0×10^{-10} m?
(Given: $m = 9.1 \times 10^{-31}$ kg, $h = 6.626 \times 10^{-34}$ Js)
10. Derive Schrodinger's wave equation for one dimension.
11. Define: i) Photoelectric effect ii) Atomic orbitals.
12. A particle having wavelength 6.6×10^{-6} m is moving with velocity 10^4 ms⁻¹. Find the mass of the particle.
13. The work function of Cs metal is 2.14 eV. Calculate the kinetic energy and the speed of the electrons emitted when the metal is irradiated with light of wavelength 700 nm.
14. What is threshold frequency? How is this frequency related to the work function?
15. An electron is confined in one dimensional box of width 4.0×10^{-10} m. Calculate its energy in the 4th energy level.
16. For one dimensional box derive the equation $E_n = \frac{n^2 h^2}{8ma^2}$
17. Explain Planck's quantum theory.
18. Write note on de-Broglie's hypothesis.
19. Define: i) Threshold frequency
ii) Atomic orbital.

Q. 12. and Q. 13.

Unit - VI

1. What are the advantages and disadvantages of Quinhydrone electrode?
2. Give any two applications of radioisotopes in
i) Bio-sciences ii) Industry.
3. Define: i) Nuclear Fusion ii) Indicator electrode
4. Give the advantages and limitations of liquid drop model.
5. What is potentiometric titration? How precipitation titration is performed potentiometrically?
6. Calculate the Q-value of the following nuclear reaction:



Given: mass of ${}^{27}\text{Al} = 26.9815$ amu, mass of ${}^4\text{He} = 4.0026$ amu,
mass of ${}^{30}\text{Si} = 29.9738$ amu, mass of ${}^1\text{H} = 1.0078$ amu

7. Explain how the pH is determined by using Quinhydrone electrode.
8. Define: i) Magic number ii) Nuclear Force.
9. Explain fission yield and fission yield curve.
10. Give the application of radioactive isotopes in
i) Agriculture ii) Medicine.
11. How pH of solution is determined by glass electrode?
12. Explain the Nuclear Force on the basis of mesons theory.
13. Define: i) pKa of the weak acid ii) Concentration cell.
iii) Q-value iv) Nuclear Fusion reactions.
14. How pH of the solution is determined using the hydrogen gas electrode?
15. Give any four evidences in favour of magic numbers.
16. Derive an equation for EMF of concentration cell without transference.
17. Give any two advantages of glass electrode.
18. Discuss the nuclear shell model.
19. Distinguish between nuclear fission and nuclear fusion reactions.
20. What are the advantages and disadvantages of glass electrode?
21. Differentiate between nuclear reactions and chemical reaction.
22. Complete the following nuclear reactions:
i) ${}^{27}\text{Al} (\alpha, n)$
ii) ${}^{14}\text{N} (p, \alpha)$