

## FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, JUNE 2019

(CUCSS—PG)

Chemistry

CH 4C 09—ADVANCED TOPICS IN CHEMISTRY

(2010 Admissions)

Time : Three Hours

Maximum : 36 Weightage

**Part A***Answer all questions.**Each question has weightage 1.*

1. Describe the nature of metal-metal bonds.
2. Explain the structure of metal-metal double and triple bonded clusters.
3. Illustrate with examples any *two* ligand based reactions of organometallic compounds.
4. Write examples of organometallic insertion reactions of carbon dioxide and carbon monoxide.
5. Explain the use of organometallic catalysts in olefin hydroboration and hydroformylation ?
6. How can acetic acid be manufactured by Monsanto method ?
7. What are the factors that govern drug design ?
8. Define prodrug and write an example.
9. Among Diels Alder cycloaddition, dehydration to form olefins and Wittig reaction, which has the highest atom economy and why ?
10. Which are the noncovalent bonding forces that direct self assembly ?
11. When can a material be termed as smart ? Write an example.
12. Illustrate the use of nano materials in biomedical diagnostics.
13. What are strong, weak and very weak hydrogen bondings ? Provide examples.
14. What is crystal engineering ? Write examples.

(14 × 1 = 14 weightage)

**Part B**

*Answer any seven questions.*

*Each question has weightage 2.*

15. What are of metal clusters ? Explain their general structure.
16. Write a note on higher metal clusters.
17. Write a note on ligand based nucleophilic addition reactions of organometallic compounds.
18. Explain carbonylation reactions of organometallic compounds.
19. Write a note on Wacker process.
20. Discuss the alkene based industrial reactions that are catalysed by organometallic compounds.
21. Write notes on (i) Phase Transfer catalysis (ii) Advantages of microwave reactions
22. Explain the important microscopy techniques that are used to visualize nano materials.
23. What is meant by drug delivery ? How can this be achieved by using nanomaterials ? Write examples.
24. Explain the term biomimetics. What are their uses and how are these made ?

(7 × 2 = 14 weightage)

**Part C**

*Answer any two questions.*

*Each question has weightage 4.*

25. How can (i) phenylbutazone ; and (ii) penicillin G be prepared ?
26. Briefly outline the fundamental principles of green chemistry.
27. Discuss the methods used for nano structure formation.
28. Write a note each on (i) Host Guest chemistry of cations, anions and neutral molecules and (ii) Supramolecular photochemistry.

(2 × 4 = 8 weightage)

**FOURTH SEMESTER M.Sc. DEGREE (SUPPLEMENTARY) EXAMINATION  
APRIL 2022**

(CUCSS)

Chemistry

CH 4E 06—NATURAL PRODUCTS AND POLYMER CHEMISTRY

(2015 to 2018 Admissions)

Time : Three Hours

Maximum : 36 Weightage

**Section A**

*Answer all questions.*

*Each question carries a weightage of 1.*

1. What is meant by biogenesis ?
2. Name the main components of clove oil.
3. What are steroids ?
4. Discuss the occurrence and properties of isoflavone.
5. What are the bases of classifications of alkaloids ?
6. Write two examples for cyanine dyes. Write the structure.
7. Explain with example metathesis.
8. Define glass transition temperature ? What is its significance ?
9. What is meant by degree of crystallinity ?
10. Explain with example swelling of a polymer.
11. What are Diene rubbers ? Give examples.
12. Write two examples for photorefractive polymers. Write the structure.

(12 × 1 = 12 weightage)

**Turn over**

**Section B**

*Answer any eight questions.*

*Each question carries a weightage of 2.*

13. How is lemon grass oil isolated ? Discuss.
14. Discuss the isolation of sandalwood oil.
15. How was the structure of Corticosterone elucidated ? Discuss.
16. Write a brief account of the medicinal importances of alkaloids.
17. Discuss the biosynthesis of quinine.
18. What are pigments ? What are the differences between a dye and a pigment ?
19. What is meant by polymerization without termination ? What are its importances ?
20. Distinguish between gelation and cross linking.
21. Discuss the method of determination of molecular weight by light scattering method.
22. How PMMA is manufactured ? What are its uses ?
23. How will you determine the degree of cross-linking of a cross-linked polymer ?
24. Discuss the phase morphology of liquid crystalline polymers.

(8 × 2 = 16 weightage)

**Section C**

*Answer two questions.*

*Each question carries a weightage of 4.*

25.
  - i) Discuss the common methods of isolation of carbohydrates.
  - ii) Explain the structure elucidation of Oesterone.
26.
  - i) Discuss the structural elucidation of atropine based on degradative reaction.
  - ii) Discuss the preparation and applications of indigo dye.

27. i) Explain the kinetics and mechanism of cationic polymerization.
- ii) Explain the chirality in polymers.
28. i) Explain the synthesis and applications of vinyl polymers.
- ii) With suitable examples, explain the use of polymers in organic synthesis.

(2 × 4 = 8 weightage)

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FOURTH SEMESTER M.Sc. DEGREE [SUPPLEMENTARY] EXAMINATION,  
APRIL 2022

(CUCSS)

Chemistry

CH4C13—ADVANCED TOPICS IN CHEMISTRY

(2015 to 2018 Admissions)

Time : Three Hours

Maximum : 36 Weightage

**Part A**

*Answer all questions.*

*Each question carries 1 weightage.*

1. What is meant by quantum size effect ?
2. Write the example for self assembly in nanomaterials.
3. Mention the limitations of microwave assisted reactions?
4. Differentiate between semi empirical and ab initio methods.
5. Write down the Z-matrix of ammonia.
6. What are crown ethers ? Give one example
7. Distinguish between drugs and prodrugs.
8. Briefly explain ELISA.
9. What is deconvolution as applied to combinatorial chemistry?
10. Explain sol gel method for the synthesis of catalysts.
11. How can you find out surface acidity of a catalyst?
12. Illustrate the principle of solar water heater. What type of materials is used for that ?

(12 × 1 = 12 weightage)

**Part B**

*Answer any eight questions.*

*Each question carries 2 weightage.*

13. Explain briefly the chemical synthesis of gold nanoparticles.
14. How can you characterize nano-materials using electronic microscopy ?
15. Discuss the principle and applications of phase transfer catalysis.
16. Give an account of basis functions commonly employed in computations.
17. Explain in detail the classification of basis sets.
18. Discuss the importance of calixarenes and cyclodextrins as molecular hosts in supramolecular chemistry.
19. Reactivity of a system can be controlled by supramolecular chemistry. Account for this statement.
20. Write an account on drug design methodology.
21. Illustrate a fluorescence immunoassay with example.
22. Compare split-mix and Furkas mix combinatorial synthesis.
23. How mesoporous materials can be used in phase transfer catalysis and biocatalysis ? Explain with examples.
24. Outline the working of a DSSC.

(8 × 2 = 16 weightage)

**Part C**

*Answer any two questions.*

*Each question carries 4 weightage.*

25. Write a note on principle, applications and various factors affecting microwave organic synthesis.
26. Outline the various steps in Hartree Fock Self Consistent Field method for solving molecules.
27. Write an account on various types of supramolecular devices.
28. List and explain various preparation methods of heterogeneous catalysts.

(2 × 4 = 8 weightage)

FOURTH SEMESTER M.Sc. DEGREE (SUPPLEMENTARY) EXAMINATION  
APRIL 2022

(CUCSS)

Chemistry

CH 4C 12—INSTRUMENTAL METHODS OF ANALYSIS

(2015 to 2018 Admissions)

Time : Three Hours

Maximum : 36 Weightage

**Section A**

*Answer all questions.*

*Each question carries a weightage of 1.*

1. Explain the terms : Student  $t$  test and  $f$  test.
2. Predict the color change interval in the titration of  $10^{-2}$  N HCl against  $10^{-2}$  N NaOH.
3. Explain with example masking and demasking in complexometry.
4. In potentiometry measurements are done when no current is passing through the system. Why ?
5. Explain with example one gas sensing electrode.
6. 800 milli-mperes of current is passed through aqueous  $\text{CuSO}_4$  solution for a period of 20 minutes. Estimate the amount of Cu deposited at Cathode.
7. What is Spectrophotometric titration ?
8. What is the use of ionization suppressors in AAS.
9. Explain terms KLL and KLM with reference to AES.
10. Name two gamma ray detectors.
11. Write Van Deempter equation. Explain.
12. Name two detector in HPLC.

(12 × 1 = 12 weightage)

**Section B**

*Answer any eight questions.*

*Each question carries a weightage of 2.*

13. The following data were obtained for the amount of N in a sample (mg). Find the standard deviation :  
30.3, 30.1, 29.9, 30.2, 30.0, 29.8.
14. With the help of one example discuss working of a redox indicator.

**Turn over**

15. Write the structure of EDTA. Discuss its application as a titrant
16. Discuss the working of a glass electrode.
17. Briefly discuss 'Anodic stripping voltammetry.
18. Write a brief account of the atomization techniques in AAS.
19. Briefly explain the working photomultiplier tube.
20. What is 'ICP' ? How is it generated ?
21. How is 'TEM' image generated ?
22. Briefly discuss thermometric titration.
23. Discuss briefly 'isotope dilution' method.
24. Discuss theory and applications of Gel Permeation Chromatography.

(8 × 2 = 16 weightage)

### Section C

*Answer any two questions.*

*Each question carries a weightage of 4.*

25. Discuss briefly theory and applications of non-aqueous titrimetry.
26. Discuss instrumentation in TG.
27. Briefly discuss theory and instrumentation in GC.
28. What is ESCA ? Write a brief account of the various techniques under ESCA.

(2 × 4 = 8 weightage)

**FOURTH SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY)  
EXAMINATION, APRIL 2022**

**April 2021 Session for SDE/Private Students**

(CBCSS)

Chemistry

**CHE 4E 08—ORGANOMETALLIC CHEMISTRY**

(2019 Admission onwards)

Time : Three Hours

Maximum : 30 Weightage

**General Instructions**

**Covid Instructions are not applicable for Pvt/SDE students (April 2021 session)**

1. *In cases where choices are provided, students can attend all questions in each section.*
2. *The minimum number of questions to be attended from the Section/Part shall remain the same.*
3. *The instruction if any, to attend a minimum number of questions from each sub section/sub part/sub division may be ignored.*
4. *There will be an overall ceiling for each Section/Part that is equivalent to the maximum weightage of the Section/Part.*

**Section A**

*Answer any eight questions.*

*Each question carries a weightage of 1.*

1. What hapticities are possible for 1,3-butadiene? Sketch the interaction.
2. Explain photosubstitution reaction of metal carbonyls with an example.
3. Discuss the nature of bonding of  $H_2$  towards a metal ion.
4. Compare the ionic character of lanthanide organometallics with that of actinide organometallics.
5. Comment on the stability of lanthanide carbonyls.
6. What is oxidative coupling reaction. Give an example.
7. Explain Fischer-Tropsch synthesis.
8. How ring opening polymerization can be used to prepare organometallic polymers? Explain with a suitable example.

**Turn over**

9. Carbon monoxide can be replaced from  $\text{Ni}(\text{CO})_4$  by  $\text{PF}_3$ , but not by  $\text{NF}_3$  or  $\text{NCl}_3$ ; why?
10. Arrange the following species in the increasing order of M-L bond energies :  
 $[\text{Cr}(\text{CO})_6]$ ,  $[\text{Mn}(\text{CO})_6]^+$ ,  $[\text{V}(\text{CO})_6]^-$ . Give reasons.

(8 × 1 = 8 weightage)

### Section B

*Answer any six questions.  
Each question carries a weightage of 2.*

11. Give an account of the classification of organometallic compounds.
12. How infrared spectroscopy can be used for identifying terminal, doubly bridged and triply bridged carbonyl groups in metal carbonyls?
13. Write briefly on the synthesis and structure of carbyne organometallics.
14. Give an account of the organometallic compounds of f-block elements.
15. Explain how 'CO insertion' occurs into  $[\text{Me Mn}(\text{CO})_5]$ . Support your answer with experimental evidences.
16. Explain the role of metal complexes in enantioselective synthesis with suitable examples.
17. What is water-gas shift reaction? Explain.
18. Write a note on organometallic dendrimers.

(6 × 2 = 12 weightage)

### Section C

*Answer any two questions.  
Each question carries a weightage of 5.*

19. What are carbene organometallics? Describe the synthesis, structure and reactivity of Fischer and Schrock carbenes.
20. Give an account of the synthesis, structure and reactivity of ferrocene.
21. Draw the catalytic cycle and mechanism of the reactions involved in Wacker process. Explain the role of a co-catalyst in this process.
22. Write briefly on :
- Collman's reagent.
  - $\sigma$ -bond metathesis.
  - Hydrosilation of alkenes.

(2 × 5 = 10 weightage)

**FOURTH SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY)  
EXAMINATION, APRIL 2022**

(CBCSS)

Chemistry

CHE 4E 07—MATERIAL SCIENCE

(2019 Admission onwards)

Time : Three Hours

Maximum : 30 Weightage

**General Instructions**

1. *In cases where choices are provided, students can attend **all** questions in each section.*
2. *The minimum number of questions to be attended from the Section / Part shall remain the same.*
3. *The instruction if any, to attend a minimum number of questions from each sub section / sub part / sub division may be ignored.*
4. *There will be an overall ceiling for each Section / Part that is equivalent to the maximum weightage of the Section / Part.*

**Section A**

*Answer any **eight** questions.*

*Each question carries a weightage of 1.*

1. Distinguish between true stress and true strain.
2. What are the optical properties of ceramic materials ?
3. Based on the properties, what are the main differences between xerogels and aerogels ?
4. What is meant by electrorefining ?
5. What is Meissner Effect ?
6. What are the applications of electroconductive polymers ?
7. What are the requirements for a polymer to be used as engineering plastics ?
8. What are the advantages of composites with metallic matrices ?
9. What is the importance of fracture mechanics ?
10. Discuss the applications of fatigue testing.

(8 × 1 = 8 weightage)

**Turn over**

**Section B**

*Answer any six questions.*

*Each question carries a weightage of 2.*

11. What are the methods used to test the hardness of a material ?
12. Compare the properties of traditional ceramics and new ceramics.
13. How will you carry out the chemical modifications of surface of a nanomaterial ? What is its significance ?
14. What are ferroelectric materials ? What are their applications ?
15. Compare the properties of low conducting and super conducting magnets.
16. Describe the production and main properties of polyacrylates.
17. Briefly describe the applications of composites.
18. Discuss the importance of fracture mechanics.

(6 × 2 = 12 weightage)

**Section C**

*Answer any two questions.*

*Each question carries a weightage of 5.*

19.
  - a) Explain the selection of materials and their applications based on design.
  - b) Briefly explain the various physical properties of ceramic materials. What are the uses of ceramic materials ?
20.
  - a) Explain the various methods of synthesis of nanoparticles.
  - b) Explain the applications of piezoelectric materials.
21.
  - a) Explain the properties of soft, hard and superconducting magnets.
  - b) What are the main polymers used as commodity plastics ? Explain one of its methods of production and properties.
22.
  - a) Explain the microstructural characterization of composites.
  - b) Explain the methods of evaluation of creep behaviour.

(2 × 5 = 10 weightage)

**FOURTH SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY)  
EXAMINATION, APRIL 2022**

(CBCSS)

Chemistry

CHE 4E 06—NATURAL PRODUCTS AND POLYMER CHEMISTRY

(2019 Admission onwards)

Time : Three Hours

Maximum : 30 Weightage

**General Instructions**

1. *In cases where choices are provided, students can attend all questions in each section.*
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**Section A**

*Answer any eight questions.*

*Each question carries a weightage of 1.*

1. How can alkaloids be isolated and purified ?
2. Write an example each of a *diterpene* and a *sesquiterpene*.
3. Outline the general structure of anthocyanins. Write examples.
4. What are squarenes? How are these prepared?
5. Explain the term “ step-growth polymerisation ” and cite examples.
6. Distinguish between glassy and rubbery states of polymers. Briefly explain the properties associated with these.
7. Briefly explain monomers, examples and properties of silicone polymers.
8. What are polymers with high band width? What are their structural features and uses ?

9. What are chiral polymers? Write an example each of a main chain and a side chain chiral polymers.
10. What are oleoresins? How can these be obtained ? Write examples.

(8 × 1 = 8 weightage)

### Section B

*Answer any six questions.*

*Each question carries a weightage of 2.*

11. Explain the classification of natural products based on (i) structure ; and (ii) biogenesis.
12. Write an account of the biosynthesis of fatty acids.
13. How is meroquinine obtained from quinine as part of quinine structure elucidation? Explain the steps by which the structure of meroquinine was established ?
14. Describe the non-covalent interactions involved in molecular recognition.
15. Write an account of copolymerisation with reference to monomers, mechanism and kinetics.
16. Explain the term degree of crystallinity of polymers. How is it determined? What is its importance?
17. Define the degree of crosslinking in polymers. How' can it be determined?
18. What are liquid crystalline polymers. Explain their structural features, properties and applications.

(6 × 2 = 12 weightage)

### Section C

*Answer any two questions.*

*Each question carries a weightage of 5.*

19. What are the general methods adopted in the (i) Isolation ; and (ii) Study of the components of essential oils.
20. Explain the structure of porphyrins. How can these be synthesised ?
21. Describe the weight average and number average molecular weights of polymers. How are these experimentally determined ?
22. Discuss the kinetics and mechanism of free radical addition polymerisations.

(2 × 5 = 10 weightage)

FOURTH SEMESTER M.Sc. DEGREE [REGULAR/SUPPLEMENTARY]  
EXAMINATION, APRIL 2022

(CBCSS)

Chemistry

CHE 4E 05—INDUSTRIAL CATALYSIS

(2019 Admission onwards).

Time : Three Hours

Maximum : 30 Weightage

**General Instructions**

1. *In cases where choices are provided, students can attend all questions in each section.*
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**Section A**

*Answer eight questions.*

*Each question carries a weightage of 1.*

1. Distinguish between associative and dissociative type of adsorption with examples.
2. Enthalpy of adsorption is a function of surface coverage. Why ?
3. Distinguish between Knudsen diffusion and bulk diffusion.
4. Distinguish between cumulative and depletive type of chemisorption.
5. Name two support material in catalysis. Justify your answer.
6. Explain with example catalyst poisoning.
7. Name a macrocyclic compound used as phase transfer catalyst. Justify.
8. Explain with example 'immobilized biocatalyst'.

9. Beta zeolite is used as cracking catalyst. Why ?
10. What is Ziegler Natta catalyst ?

(8 × 1 = 8 weightage)

### Section B

*Answer six questions.*

*Each question carries a weightage of 2.*

11. Briefly discuss capillary condensation.
12. Discuss geometric factors in catalysis.
13. Discuss synthetic methods of zeolites.
14. Write a brief account of deactivation of catalysts.
15. Discuss the use of PEG as a phase transfer catalyst.
16. What are the methods of enzyme immobilization ? Discuss.
17. Write a brief account of catalysts employed in pollution control from automobiles.
18. Discuss catalytic conversion of methanol to acetic acid.

(6 × 2 = 12 weightage)

### Section C

*Answer any two questions.*

*Each question carries a weightage of 5.*

19. What are the methods for the determination of surface area of a solid ? Discuss.
20. Distinguish between Langmuir-Hinshelwood and Rideal mechanism of bimolecular surface catalysed reaction. How would you establish the mechanism under a given set of conditions ?
21. Write a brief account of catalytic reforming.
22. Write a brief account of catalysis by semiconducting oxides.

(2 × 5 = 10 weightage)

**FOURTH SEMESTER M.Sc. DEGREE [REGULAR/SUPPLEMENTARY]  
EXAMINATION, APRIL 2022**

(CBCSS)

Chemistry

CHE 4E 04—PETROCHEMICALS AND COSMETICS

(2019 Admission onwards)

Time : Three Hours

Maximum : 30 Weightage

**General Instructions**

1. *In cases where choices are provided, students can attend all questions in each section.*
2. *The minimum number of questions to be attended from the Section / Part shall remain the same.*
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4. *There will be an overall ceiling for each Section / Part that is equivalent to the maximum weightage of the Section / Part.*

**Section- A**

*Answer any eight questions.*

*Each question carries a weight of 1.*

1. What is the cause for knocking in internal combustion engines ?
2. Describe the major saturated and unsaturated hydrocarbons from natural gas.
3. What is rectified spirit ? How can it be industrially obtained ?
4. Identify the sulphur containing impurities in petroleum the presence of which decrease the value of petroleum. Why is their presence in petroleum considered a problem ?
5. How are desalting and emulsion removal achieved before crude petroleum processing?
6. How are petroleum products classified ? Write examples.
7. Describe the purification of petroleum products using a DC electric field.
8. Describe the hydrorefining purification of petroleum products.

9. What are natural musks and nitromusks ?
10. What is meant by flowery and fruity odours? Write an example each for these two classes.

(8 × 1 = 8 weightage)

### Section B

*Answer any six questions.*

*Each question carries a weight of 2.*

11. Define Octane Number and Cetane Number and describe their significance with respect to internal combustion engine fuels.
12. Explain the chemical processing of aromatic and paraffinic hydrocarbons from natural gas and petroleum.
13. Describe the industrial manufacture and uses of phenol, acetone and formaldehyde.
14. Discuss the classification and composition of crude petroleum.
15. Describe the different types of distillation columns used in petroleum distillation.
16. Write an account of the major petroleum products, citing appropriate examples.
17. Illustrate the absorptive and adsorptive processes of petroleum product purification.
18. Write an account of the preparation and ingredients of deodorants and antiperspirants

(6 × 2 = 12 weightage)

### Section C

*Answer any two questions.*

*Each question carries a weight of 5.*

19. Write brief notes on petroleum : (i) Refining and (ii) cracking; with attention to process details, any catalysts needed and the products arising there from in these two respective processes.
20. Discuss in detail, and with suitable examples, the major chemical processes used in organic synthesis at industrial scale.
21. What are the major physical properties that are determined in characterising petroleum crude? How are these measured ?
22. Write brief notes on : (i) Preparation of toothpaste ; (ii) Ingredients of shampoo ; (iii) Composition of hair dye ; (iv) Fixation of delicate odours in perfumes ; and (v) recipe for colognes.

(2 × 5 = 10 weightage)

FOURTH SEMESTER M.Sc. DEGREE [REGULAR/SUPPLEMENTARY]  
EXAMINATION, APRIL 2022

(CBCSS)

Chemistry

CHE 4C 12—INSTRUMENTAL METHODS OF ANALYSIS

(2019 Admission onwards)

Time : Three Hours

Maximum : 30 Weightage

**General Instructions**

1. *In cases where choices are provided, students can attend all questions in each section.*
2. *The minimum number of questions to be attended from the Section / Part shall remain the same.*
3. *The instruction if any, to attend a minimum number of questions from each sub section / sub part / sub division may be ignored.*
4. *There will be an overall ceiling for each Section / Part that is equivalent to the maximum weightage of the Section / Part.*

**Section A**

*Answer any eight questions.*

*Each question carries a weightage of 1.*

1. Calculate the co-efficient of variation for the following set of analytical data of a sample A : 4.68, 4.70, 4.04, 4.31, 4.14 mg.
2. During the titration of  $\text{Fe}^{2+}$  against potassium dichromate in acid medium using diphenylamine indicator, orthophosphoric acid is added ; why ?
3. Define half-wave potential. Explain its significance in polarography.
4. What is anodic stripping voltammetry ? Explain.
5. Explain the principle of fluorimetry.
6. Outline the principle involved in ESCA.

**Turn over**

7. The DTA profile of calcium oxalate monohydrate shows an exothermic peak in oxygen atmosphere, but not in nitrogen atmosphere. Account for this observation.
8. Mention two substances that can be used for column chromatography. What should be their general characteristics?
9. Define : a) Student's t-test ; and b) Q-test.
10. Describe the function of an adsorption indicator, with a suitable example.

(8 × 1 = 8 weightage)

### Section B

*Answer any six questions.*

*Each question carries a weightage of 2.*

11. Discuss the method of least square for the treatment of analytical data. What do you mean by linear correlation coefficient.
12. Write briefly on titrations in non-aqueous media.
13. Critically evaluate the graphical methods for determining the end point in potentiometric titrations.
14. What are the parameters involved in coulometric titrations. Mention the advantages of this technique.
15. Discuss the principle of hollow cathode lamp ? What are its main advantages.
16. What is Auger effect ? How do you distinguish between XPS peaks and AES peaks in an electron spectrum ?
17. Explain the principle involved in isotope dilution method. Mention its important applications.
18. What are the characteristics of an ideal detector of gas chromatography ?

(6 × 2 = 12 weightage)

### Section C

*Answer any two questions.*

*Each question carries a weightage of 5.*

19. Discuss the theory and experimental setup involved in polarography. Explain its important applications.
20. What is the principal information to be obtained in the UV-Visible region ? Sketch the diagram and explain the basic principle, instrumentation and applications of a double beam UV-Visible spectrophotometer. What is meant by the term 'signal to noise ratio' in a spectrophotometer ?

21. Describe the principle, instrumental setup and applications of HPLC. What are advantages of HPLC when compared to other methods of chromatography ?
22. Write briefly on :
- a) Indicator electrodes.
  - b) Theory of SEM and its application in surface analysis.
  - c) Neutron activation analysis.

(2 × 5 = 10 weightage)

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**Section B**

*Answer all questions.*

*Each question carries 2 marks.*

13. Chelate effect is often referred to as an entropy effect. Explain.
14. What are Ionophores ? How are they classified ?
15. Comment on the structural features and functions of ceruloplasmin.
16. How does hemocyanin differ from its oxy form ?
17. What is sickle cell anemia ? Explain its origin.
18. Explain the role of  $Mg^{2+}$  in phosphate group transfer.

(6 × 2 = 12 marks)

**Section C**

*Answer any six questions.*

*Each question carries 6 marks.*

19. Discuss the factors that affect the stability of metal complexes.
20. Justify, nature's unique selection of Zn in enzymatic activity and in nucleic acid activity.
21. Describe the basis of designing 'synthetic blood'. Mention the limitations of this model.
22. Discuss the role of copper proteins in electron transport process.
23. Explain the role of gold complexes for the treatment of rheumatoid arthritis.
24. Bring out the role of nitrogenase in biological nitrogen fixation. What are the different electron sources in nitrogenase activity ?
25. Write a note on DNA replication.
26. Differentiate between active and passive transport across cell membranes, giving the mechanism of each.
27. Explain how indicator plants can be made use of in the assessment of soil pollution.

(6 × 6 = 36 marks)

**Turn over**

**Section D**

*Answer any two questions.*

*Each question carries 10 marks.*

28. What is trans effect? Discuss the theories suggested to explain this and give any *one* of the synthetic applications of trans effect.
29. Compare the structure and functions of hemoglobin and myoglobin. Explain the origin of co-operativity of O<sub>2</sub> binding with hemoglobin. What is significance of Hill co-efficient?
30. How does magnesium alter the properties of porphyrin ring system, making it functionally suitable for photosynthesis. Explain the functions of PS-I and PS-II in photosynthetic process.
31. Write briefly on :
  - a) Toxic effect of lead ;
  - b) Plastocyanin ; and
  - c) Vitamin B<sub>12</sub>.

(2 × 10 = 20 marks)