

R-4579

Sub. Code

538201

M.Sc. DEGREE EXAMINATION, APRIL 2021

Second Semester

Chemistry (Spl. in NST)

INORGANIC CHEMISTRY – II

(CBCS – 2019 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(10 × 2 = 20)

Answer **all** the questions.

1. State Jahn Teller theorem.
2. $[\text{NiCl}_4]^{2-}$ has T_d geometry while $[\text{PtCl}_4]^{2-}$ adopts square planar geometry. Reason out.
3. What do you mean by trans effect?
4. State and explain lability and inertness of coordination complexes.
5. How nitrosyl complexes can be prepared from nitrosonium sources?
6. Which of the following will exhibit lower carbonyl stretching frequency? Give reasons for your answer.
 - (a) $[\text{Mn}(\text{CO})_6]^+$
 - (b) $[\text{Cr}(\text{CO})_6]$
 - (c) $[\text{V}(\text{CO})_6]^-$.

7. Among the complexes $[(\text{Ph}_3\text{P})_2\text{Pt}(\text{CH}_3)_2]$ and $[(\text{Me}_3\text{P})_2\text{Pt}(\text{CH}_3)_2]$ which one is resistant to elimination reactions? Give reasons.
8. Mention the advantages of Ziegler-Natta catalyst over traditional polymerization method.
9. Mention the properties and biological applications of calcium phosphate.
10. What are the primary processes in photosynthesis?

Part B

(5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) Discuss the factors affecting the magnitude of $10 Dq$.

Or

- (b) Explain why nickel ferrite has inverse spinel structure.
12. (a) Predict the products and justify your answer.
 - (i) $[\text{Pt}(\text{CO})\text{Cl}_3]^- + \text{NH}_3$
 - (ii) $[\text{Pt}(\text{NH}_3)\text{Br}_3]^- + \text{NH}_3$.

Or

- (b) Discuss the factors affecting substitution reactions in complexes.
13. (a) Explain with examples, the usefulness of 18 electron rule and give its limitations.

Or

- (b) Ferrocene is aromatic – Justify.

14. (a) Explain the mechanism of CO insertion reactions of organometallic compounds.

Or

- (b) Write a note on oxidative addition reactions of organometallic complexes.
15. (a) With suitable examples, explain the detoxification by metal chelation.

Or

- (b) Discuss on the charge separation and electron transport in photosynthesis.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Explain with examples the VB theory of coordination complexes.
17. Illustrate with suitable examples, SN¹ CB mechanisms of substitution reaction in octahedral cobalt (III) complexes.
18. Discuss the structure and bonding in carbonyl complexes. How IR spectroscopy is helpful in their structural elucidation?
19. What is Wilkinson's catalyst? Explain the mechanism of hydrogenation of olefins using Wilkinson's catalyst.
20. Discuss the role of porphyrin and corrin as ligands in biological systems.

R-4580

Sub. Code

538202

M.Sc. DEGREE EXAMINATION, APRIL 2021

Second Semester

Chemistry (Spl in NST)

ORGANIC CHEMISTRY – II

(CBCS – 2019 onwards)

Time : 3 Hours

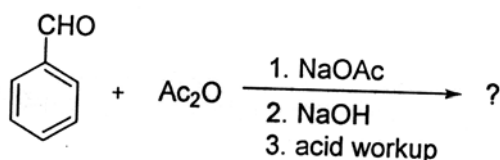
Maximum : 75 Marks

Part A

(10 × 2 = 20)

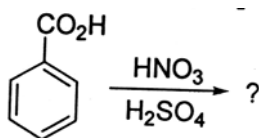
Answer **all** questions.

1. What is the mechanism of hydroboration-oxidation reaction?
2. Differentiate the reactivity of LAH and NaBH₄.
3. What is the rearrangement reaction that is used to convert an alcohol to an olefin through a 1,2-shift?
4. What is the product formed from the given Perkin reaction?



5. Anisole undergoes bromination faster than benzene. Why?

6. Predict the major product of the following reaction.



7. Write down the structures of vitamin A and K.
8. What are the functions of nucleic acids?
9. What are the applications of paper chromatography?
10. What do you mean by analyte and eluent in chromatography?

Part B (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) Give the synthetic utilities of N-bromosuccinimide and periodic acid.

Or

- (b) Write notes on the metal catalyzed hydrogenation reactions. Give examples.

12. (a) Explain Beckmann rearrangement. Support with mechanism.

Or

- (b) Elaborate the mechanism of Knoevenagel reaction.

13. (a) Discuss in detail the benzyne mechanism. Give examples.

Or

- (b) Write down the mechanism of Kolbe-Schmidt reaction.

14. (a) How will you prepare androsterone from cholesterol?

Or

- (b) Discuss the structural features of RNA and DNA.
15. (a) Write a note on column chromatography. What are the applications?

Or

- (b) Discuss the basic principle and applications of HPLC.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. (a) Comment on the mechanism of McMurry reduction.
(b) What are the synthetic uses of SeO_2 and OsO_4 ? (5+5)
17. Explain the following reactions with mechanism: (5+5)
(a) Perkin (b) Bayer-Villiger
18. Explain the mechanisms of the following reactions: (5+5)
(a) Kolbe-Schmidt (b) Chichibabin
19. Elaborate the total synthesis of testosterone and progesterone.
20. Discuss the principle, working, instrumentation and applications of GC.

R-4581

Sub. Code

538203

M.Sc. DEGREE EXAMINATION, APRIL 2021

Second Semester

Chemistry (Spl. In Nanoscience and Tech.)

PHYSICAL CHEMISTRY – II

(CBCS – 2019 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(10 × 2 = 20)

Answer **all** questions.

1. Define quantum numbers with examples.
2. Explain tunneling effect.
3. Assign point group to each of the following molecules:
 - (a) Boric acid,
 - (b) Cis- H₂O₂,
 - (c) Naphthalene,
 - (d) PtCl₄
4. Write any two group postulates.
5. Write the symmetry selection rule for rotational spectroscopy.
6. Explain the mutual exclusion principle for molecules with center of symmetry.

7. Write any two examples for chain branching explosion reactions.
8. Explain a short note on the kinetics of stepwise polymerization.
9. What is meant by surface tension and explain with examples.
10. Differentiate between physisorption and chemisorptions.

Part B

(5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) Explain about the energy of rigid rotator using wave mechanics.

Or

- (b) Explain about Jahn-Teller effect.
12. (a) Discuss about reducible and irreducible representations.

Or

- (b) Give a brief note on Great orthogonality theorem and its consequences.
13. (a) Discuss in detail about the selection rules for $n - \pi^*$ and $\pi - \pi^*$ transitions in formaldehyde.

Or

- (b) Explain the application of group theory to IR spectral activity of vibrational modes of ammonia molecule.

14. (a) Describe the mechanism of enzyme inhibition in enzyme catalysis.

Or

- (b) Explain flash photolysis method for the kinetics of fast reactions.
15. (a) Define Adsorption isotherm. Write about the Freundlich and BET adsorption isotherm.

Or

- (b) Write about the basic aspects of semiconductor catalysis and its applications.

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. Derive an expression for three-dimensional particle in a box by potential well diagram.
17. What are character tables? Construct the character table for C_{3v} point group. Discuss the significance of each area of the table.
18. Write down the SALC procedure and its application to butadiene molecule.
19. Explain the kinetics of fast reactions by relaxation methods (T and P – jump methods).
20. Describe in detail about the Rideal-Eley mechanism of heterogeneous catalysis.

R-4582

Sub. Code

538503

M.Sc. DEGREE EXAMINATION, APRIL 2021.

Second Semester

Chemistry (Spl. in NS&T)

**SYNTHESIS AND CHARACTERIZATION TECHNIQUES
OF NANOMATERIALS**

(CBCS – 2019 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(10 × 2 = 20)

Answer **all** the questions.

1. Write a short notes on MOCVD.
2. Give the application of Hydrothermal process.
3. Write the principle of XPS.
4. Define Mass spectroscopy.
5. Explain the fundamental principle of TGA.
6. Write the application of TGA.
7. What is Resolution and Contrast?
8. Define lattice fringes and their application.
9. Define force curves from AFM.
10. Define the optical lever.

Part B**(5 × 5 = 25)**Answer **all** questions by choosing either (a) or (b)

11. (a) Briefly note on Spray pyrolysis.

Or

- (b) Explain the use of magnetotactic bacteria for synthesis of magnetic nanoparticles.

12. (a) Explain the theory of Photoluminescence spectroscopy.

Or

- (b) Explain the principle and theory of NMR Spectroscopy.

13. (a) What is the difference between the heat flow calibration and temperature calibration?

Or

- (b) Write about the thermal analysis.

14. (a) Write difference between the SEM and TEM.

Or

- (b) Write difference between the HR-SEM and HR-TEM.

15. (a) Explain in detail about the principle of AFM.

Or

- (b) Discuss about the tapping mode?

Part C $(3 \times 10 = 30)$

Answer any **three** questions.

16. Explain in detail about Langmuir-Blodgett films.
 17. Explain the Electron Spin Response Spectroscopy.
 18. Discuss about the determination of degree of conversion of high alumina cement.
 19. Discuss about the structure of grain boundaries and interfaces HR-TEM.
 20. Explain about the Imaging and manipulation of samples in air or liquid.
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R5470

Sub. Code

538507

M.Sc. DEGREE EXAMINATION, APRIL – 2021.

Fourth Semester

Chemistry (Spl. in Nanoscience and Tech)

NANOCOMPOSITES

(CBCS – 2019 onwards)

Time : Three Hours

Maximum : 75 Marks

Part A

(10 × 2 = 20)

Answer **all** questions.

1. Distinguish nanoparticle and nanocomposite.
2. Write the physical features of nanocomposites?
3. Distinguish between Core-shell and alloy nanocomposites.
4. State the uses of metal-metal nanocomposites.
5. State which material is best for ultra lightweight spacecraft.
6. Provide advantages of conducting polymer nanocomposites.
7. What is meant by self-assembly.
8. Write the advantages of synthetic nanocomposite for bone.
9. How polymer nanocomposites are used in pharmaceutical applications?
10. State electrical application of nanocomposites.

Part B

(5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) Discuss in detail about the electronic and atomic structure of nanocomposites.

Or

- (b) Discuss in detail about the preparation and characterization of nanocomposites.

12. (a) Discuss preparation and properties of metal-oxide nanocomposites.

Or

- (b) Write short notes on glass-metal nanocomposites.

13. (a) Write short notes on copolymer based nanocomposites.

Or

- (b) How nanocomposites are suitable for exterior automatic components.

14. (a) Write short notes on organic-inorganic nanocomposites.

Or

- (b) Write short notes on natural nanocomposites.

15. (a) Discuss in detail about electronic applications of polymer metal based nanocomposites.

Or

- (b) Write short notes on textile applications of nanocomposites.

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. Explain in detail about designing, stability and mechanical properties of Super hard nanocomposites.
 17. Explain in detail about Metal-Ceramic matrix nanocomposites.
 18. Explain in detail about Polymer CNT based nanocomposites.
 19. Explain in detail about Bio-mimetic synthesis of nanocomposites.
 20. Explain in detail how polymer and polymer metal based nanocomposites are suitable for energy applications.
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