

R5803

Sub. Code

536101

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Chemistry

INORGANIC CHEMISTRY – I

(CBCS – 2019 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(10 × 2 = 20)

Answer **all** questions.

1. Define electronegativity and electron affinity.
2. Calculate the bond order for N₂ and CO molecules.
3. Calculate the CFSE of $Co(H_2O)_6^{2+}$ and $Co(NH_3)_6^{3+}$ complexes.
4. Write any two limitations of VB theory.
5. Define LF theory.
6. State Huckel theory.
7. What are voids? How they can be classified?
8. Define critical radius ratio. What are the coordination number and shape for those compounds having radius ratio of 0.332 and 0.523 respectively.
9. f-block elements are called inner transition elements. Why?
10. What is lanthanide contraction?

Part B

(5 × 5 = 25)

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

11. (a) What are the limitations of HSAB theory.

Or

- (b) Draw the molecular orbital diagram of O₂ molecule.

12. (a) Write a note on Jahn-Teller distortion.

Or

- (b) What are the factors affecting the magnitude of 10 Dq.

13. (a) Discuss the differences and similarities between CFT and MOT.

Or

- (b) Draw the MO diagram of [Co(NH₃)₆]³⁺ complex.

14. (a) Explain packing efficiency, how it can be calculated for closed packing system?

Or

- (b) Describe fluorite and antifluorite structures.

15. (a) (i) Explain why 4f electrons do not take part in bonding? (3)

- (ii) Which is thermally more stable and why?
La(NO₃)₃ and Tm(NO₃)₃. (2)

Or

- (b) Actinides have a greater tendency for complex formation than lanthanides. Explain with suitable examples.

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. Discuss the following hybridization
(a) sp^3 (b) sp^3d^2 (c) dsp^2 . (3+4+3)
17. Discuss elaborately about splitting of d-orbitals in square, trigonal bipyramidal, octahedral and tetrahedral complexes.
18. Based on MO theory explain about the formation of sigma and pi bonding in octahedral complexes.
19. Discuss on the following structures with suitable examples;
(a) Calcium carbide
(b) Wurtzite (5+5)
20. Discuss elaborately about the various methods involved for separation of lanthanides.
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R5804

Sub. Code

536102

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Chemistry

ORGANIC CHEMISTRY – I

(CBCS – 2019 onwards)

Time : 3 Hours

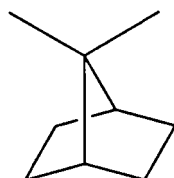
Maximum : 75 Marks

Part A

(10 × 2 = 20)

Answer **all** questions.

1. What is electromeric effect?
2. Write the IUPAC of the following compound:



3. State significance of Hammond postulate
4. Define crossover experiment.
5. Write the significance of E2 mechanism.
6. Define orientation and reactivity.
7. Give the importance of chirality.
8. Define diastereoisomers.

9. How does steric effect influences the conformational analysis?
10. Define syn-elimination.

Part B (5 × 5 = 25)

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

11. (a) Distinguish between inductive effect and resonance affect.

Or

- (b) Write the aromaticity of azulene.

12. (a) Write briefly the primary and secondary kinetic isotopic effect.

Or

- (b) Write Hammett equation.

13. (a) Write a short note on nucleophilic substitution at a vinylic carbon.

Or

- (b) Write the arenium ion mechanism.

14. (a) Distinguish between space configuration and conformational stereoisomers.

Or

- (b) Illustrate E – Z nomenclature with example.

15. (a) Why conformational analysis is important in organic chemistry? Explain.

Or

- (b) What is E2 elimination? Give the mechanism.

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. Explain with the suitable example of hyperconjugation is permanent effect.
 17. Define Curtin-Hammett principle. Explain with the suitable example.
 18. Discuss briefly the mechanisms of S_E1 , S_E2 and S_Ei with their stereochemical implications. Also state why these are limited compared to aliphatic nucleophilic substitution reactions.
 19. Discuss briefly the Newman projection formula of *n*-butane.
 20. Discuss briefly Woodward, Prevost method of neighbouring group participation with suitable example.
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R5805

Sub. Code

536103

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Chemistry

PHYSICAL CHEMISTRY – I

(CBCS – 2019 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(10 × 2 = 20)

Answer **all** questions.

1. What is photo-electric effect?
2. What is wave function?
3. Prove that S_n axis is same as C_n axis when n is odd.
4. What is the point group of allene and 1, 2dichloromethane?
5. Write the difference between the order of the reaction and molecularity.
6. What is activation energy?
7. What is Bosons?
8. What is the need for second law of thermodynamics?
9. Define phosphorescence.
10. What is open-circuit voltage (V_{oc})?

Part B

(5 × 5 = 25)

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

11. (a) (i) Describe the wave length shift effect in quantum mechanism.
(ii) Define work function.

Or

- (b) Discuss Heisenberg's uncertainty principle and its significances.

12. (a) Construct the character table for C_{2v} point group.

Or

- (b) Discuss the procedure for the determination of inverse of matrix with suitable examples.

13. (a) Discuss about the kinetic isotopic effect.

Or

- (b) Derive Eyring equation and give its applications.

14. (a) Discuss the change in equilibria with respect to pressure and temperature.

Or

- (b) Describe how the free electron model of metals report the high conductivity of metals.

15. (a) Describe any one of the method to determine the quantum yield.

Or

- (b) How the impedance spectroscopy interpreted in dye sensitized solar cells?

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. (a) Derive the time independent Schrodinger equation for particle moving in 1D and 3D directions.
(b) Prove that the angular momentum operation is Hermitian.
 17. Explain and derive the proof for the great orthogonality theorem.
 18. Derive mathematical formulation of Lindemann – Hinshelwood mechanism.
 19. Explain and demonstrate the conversion of heat into work in an ideal gas system with reversible cycle.
 20. Draw the schematic diagram of dye sensitized solar cell and explain its principle and working mechanism.
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R5806

Sub. Code

536051

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Chemistry

INSTRUMENTAL METHODS OF ANALYSIS

(CBCS – 2019 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(10 × 2 = 20)

Answer **all** questions.

1. What are the different types of chromatography?
2. State partition chromatography?
3. Define accuracy with example?
4. Discuss finger print region?
5. What is meant by AAS and give its principle?
6. Write any two advantages and disadvantages of turbidimetry?
7. What is meant by differential thermal analysis?
8. State the principle of X-ray diffractometer?
9. Define ISFETs and CHEMFETs?
10. Elucidate the term chronoamperometry?

Part B

(5 × 5 = 25)

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

11. (a) Discuss briefly the various types of detectors that are used in HPLC?

Or

- (b) Explain various applications of thin layer chromatography?

12. (a) Name the different types of errors and explain with suitable example?

Or

- (b) Explain the anisotropic effects in acetylene, ethylene and benzene?

13. (a) Write the notes on the following:

(i) Fluorescence

(ii) Phosphorescence

Or

- (b) Describes the principle and working of flame photometer with the schematic representation?

14. (a) Discuss the principle and applications of scanning electron microscopy?

Or

- (b) Draw the TGA curve for AgNO_3 and explain?

15. (a) Discuss the basic principles involved in electrochemical sensor with applications?

Or

- (b) Explain the theory and applications of electrogravimetry?

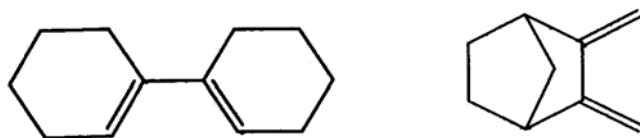
Part C

(3 × 10 = 30)

Answer any **three** questions.

16. Name the detectors that are used in gas chromatography and explain any two with diagram?

17. (a) Using Woodward Fieser rule, calculate the absorption maxima for the following: (5)



(b) What is nitrogen rule? Explain? (5)

18. Elaborately explain the instrumentation of atomic spectroscopy?

19. Describe the principle, working and applications of TEM for the characterization of nanomaterials?

20. Write briefly the quantitative applications of potentiometry and voltammetry?

R5807

Sub. Code

536301

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Chemistry

ADVANCED INORGANIC CHEMISTRY

(CBCS – 2019 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(10 × 2 = 20)

Answer **all** the questions.

1. What are metal carbenes?
2. What is ferrocene? Draw the structure.
3. What is reductive elimination reaction?
4. Write the Pauson-Khand reaction.
5. State Hund's rule.
6. Define the term "Nephelauxetic effect".
7. Write the definition of ionophores.
8. What is the formula for *cis*-platin? Draw the structure.
9. Mention any two functions of myoglobin.
10. Draw the chlorophyll structure.

Part B

(5 × 5 = 25)

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

11. (a) Discuss the ring opening metathesis in organic synthesis.

Or

- (b) Write about cyclopentadienyl complexes with an example.

12. (a) Explain about fluxional molecules with an example.

Or

- (b) Discuss the Ziegler-Natta polymerization reaction with an example.

13. (a) Discuss the Orgel diagram for d^2 electron configuration.

Or

- (b) How to determine the magnetic susceptibility using Gouy balance?

14. (a) Explain the role of sodium-potassium ion pump.

Or

- (b) Write the therapeutic applications of *cis*-platin.

15. (a) Discuss the perutz mechanism in porphyrin ring system.

Or

- (b) Explain the role of cytochrome P-450 in the drug metabolism.

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. Briefly discuss about the synthesis and reactivity of metal arene complexes.
 17. Explain the nucleophilic and electrophilic attack on coordinated ligands in organometallic complexes.
 18. Describe the different types of magnetism.
 19. Explain the photosystem 1 and 2 with an example.
 20. Discuss about the structure and functions of Fe-S proteins.
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R5808

Sub. Code

536302

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Chemistry

ADVANCED ORGANIC CHEMISTRY

(CBCS – 2019 onwards)

Time : 3 Hours

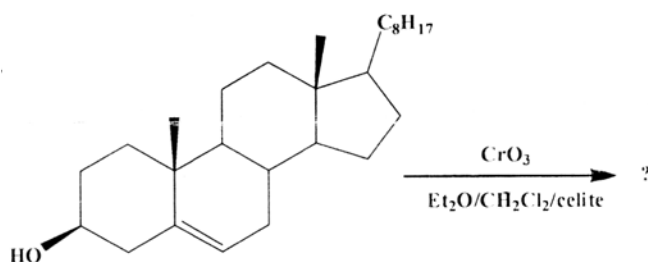
Maximum : 75 Marks

Part A

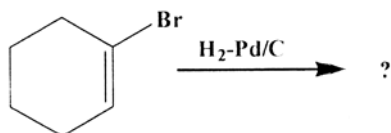
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Answer all questions.

1. Write the product of the following organic reaction:

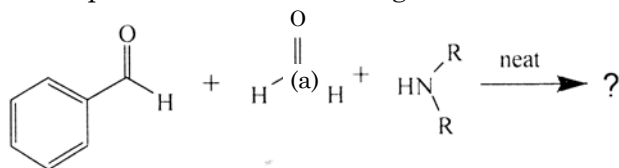


2. What is Provoost reaction?
3. Predict the product of the following reaction:



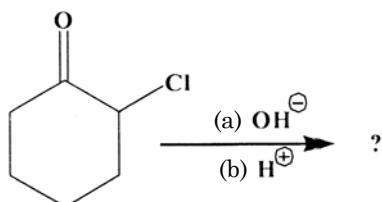
4. Define Luche reduction.
5. What is Tishchenko reaction? Give example

6. Write the product of the following reaction:



7. Define Bachmann cyclization.

8. Write the product of the following organic reaction:



9. What is meant by retrosynthetic analysis?

10. Define 'regioselectivity'.

Part B

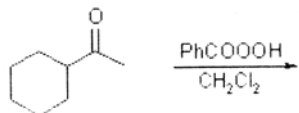
(5 × 5 = 25)

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

11. (a) Write the synthesis and mechanism of Sharpless asymmetric epoxidation.

Or

(b) Predict the product and suitable mechanism of the following reaction:



12. (a) Write Pinacol formation and mechanism.

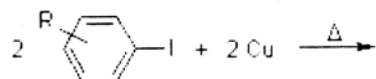
Or

(b) What is Meerwein-Ponndorf-Verley reduction? Give the mechanism.

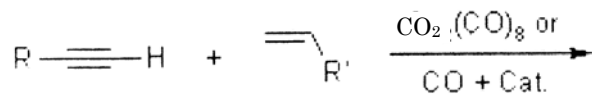
13. (a) What is Henry reaction? Give the example and mechanism.

Or

- (b) Predict the product with suitable mechanism of the following reaction:



14. (a) Write the product and suitable mechanism of the following reaction:



Or

- (b) Write down the mechanism of the ring closing metathesis.
15. (a) What is meant by functional group interconversion? Explain with an example.

Or

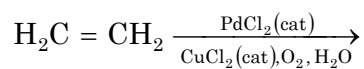
- (b) Discuss the retrosynthetic analysis of Jasmone.

Part C

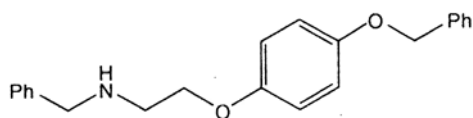
(3 × 10 = 30)

Answer any **three** questions.

16. Predict the product and suitable mechanism of the following reaction:



17. Write the synthesis and mechanism of
- (a) Nef reaction
 - (b) Tebbe olefination. (5+5)
18. Write the principle, synthesis and applications of phase transfer catalysis in modern organic synthesis.
19. What is Nazarov cyclization reaction? Explain with mechanism.
20. Suggest the retrosynthetic analysis and total synthesis of the following target molecule:



R5809

Sub. Code

536303

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Chemistry

ADVANCED PHYSICAL CHEMISTRY

(CBCS – 2019 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(10 × 2 = 20)

Answer **all** questions.

1. Write the ground state term symbol for carbon atom.
2. State Pauli's anti symmetry principle.
3. What is change in the rotational constant B of H₂ molecule when replace both hydrogen atom by deuterium?
4. The far infrared spectrum of HI consists of series of equally spaced lines with $\Delta\bar{\nu} = 12.8 \text{ cm}^{-1}$. What is the internuclear distance?
5. What is passivity?
6. What are fuel cells? Give an example.
7. What is entropy production?
8. What is meant by canonical ensemble?
9. What are intrinsic and extrinsic semi conductors?
10. What is Meissner effect?

Part B

(5 × 5 = 25)

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

11. (a) Discuss the self consistent field methods.

Or

- (b) Explain the spin-orbit couplings.

12. (a) Derive an expression for the intensities of rotational spectral lines.

Or

- (b) Discuss the Franck Condon principle.

13. (a) Explain the Pourbaix diagram for Fe–H₂O system.

Or

- (b) Discuss the Lead-acid battery and Ni-Cd battery.

14. (a) Compare Maxwell Boltzmann, Bose-Einstein and Fermi-Dirac statistics.

Or

- (b) Calculate the translational partition function for one mole of nitrogen at 2 atm at 27°C assuming the gas behave ideally.

15. (a) Explain the Schottky and Frenkel defects.

Or

- (b) Describe investigation of internal structure of a solid by X-ray diffraction (Bragg's method).

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. Obtain an expression for eigen function and eigen value for hydrogen molecule ion.
17. What type of vibrational rotational spectra is obtained for a diatomic molecule taking it as an harmonic oscillator?
18. Discuss the electrochemical methods of corrosion rate measurements by DC and AC methods.
19. Derive Onsager's reciprocal relations and explain their significance.
20. Discuss the band theory of semi conductors.
