R6039	Sub. Code
	538101

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Chemistry (Spl in NST)

INORGANIC CHEMISTRY – I

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Define bond order with examples.

2. Interpret the structure and hybridization of NH_3 and $POCl_3$ using VSEPR theory.

3. Write the styx notation for B_5H_{11}.

4. Mention the various types of silicates.

5. Give any four examples for AB type crystals.

6. Differentiate between electrical conductivity and super conductivity.

7. What is the possible mode of decay in nuclear reactions?

8. Calculate Q-Value of the following nuclear reaction

   $_3Li^7 + _1H^1 \longrightarrow 2_2He^4$

   Check whether the reaction is exoergic or endoergic. [Exact mass of $_3Li^7$ isotope = 7.01601 a.m.u., $_1H^1$ = 1.00738 a.m.u., and $_2He^4$ = 4.00260 a.m.u.]

9. Describe any two uses of actinides.

10. Write the general electronic configuration of inner transition elements.

Part B $(5 \times 5 = 25)$

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

11. (a) Construct the Born Haber cycle for sodium chloride.

Or

(b) Summarize VSEPR theory with any three examples.

12. (a) Write about the synthesis and structure of phosphazene.

Or

(b) Using Wade's rule, interpret the structure of the following compounds

(i) B_2H_6 (ii) $C_2B_7H_{13}$

(iii) $B_2H_7^{2-}$

13. (a) Evaluate the packing fraction of SC, FCC and HCP structures.

Or

(b) Discuss the structure of anti-fluorite in detail.

14. (a) Describe the carbon-nitrogen cycle in nuclear fusion reaction.

Or

(b) Explain briefly about radio carbon dating method.

15. (a) Describe the selective reduction and oxidation method for the separation of lanthanides.

Or

(b) Distinguish between the salient features of lanthanides and actinides.

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

Answer any **three** questions.

16. Explain how MO theory is applied to diatomic molecules like H_2 and CO. (5+5)

17. (a) Define isolobal analogy. (2)

(b) Which organometallic compound is isolobal to CH_3^+ fragment? (2)

(i) $[Fe(CO)_5]$ (ii) $[Cr(CO)_5]$

(iii) $[Mn(CO)_5]$ (iv) $[Ni(CO)_3]^+$

(c) Discuss about tetra nuclear and hexa nuclear clusters with examples. (4)

(d) Write about isopoly acids with suitable examples. (2)

18. Discuss the structure of sodium chloride and rutile in detail.

19. Describe elaborately about the usage of radio isotopes in neutron activation analysis.

20. Mention the spectral and magnetic properties of lanthanides and actinides.

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R6040	Sub. Code
	538102

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Chemistry (Spl. in Nano Science & Tech.)

ORGANIC CHEMISTRY – I

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** the questions.

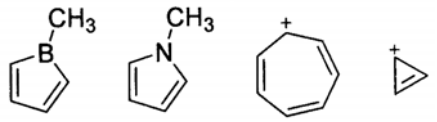
1. How will you generate singlet and triplet carbenes?

2. Write down the features of energy profile diagram?

3. What are the types of nucleophiles?

4. Write down the E1cB mechanism.

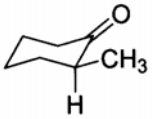
5. Which of the compounds are not aromatic? Justify your answer. (1+1)



I II III IV

6. State whether [12]-annulene is aromatic, non-aromatic or anti-aromatic. Support your answer. (1+1)

7. State whether the following compounds are chiral or achiral. Support your answer. (1+1)



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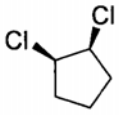


II

8. What is a diastereoselective reaction? Give an example.

9. Distinguish configuration and conformation.

10. Write down the stable conformation of 1-methyl-2-chlorocyclohexane. Justify your answer.

Part B (5 × 5 = 25)

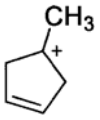
Answer **all** the questions, choosing either (a) or (b).

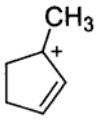
11. (a) How kinetic isotope labelling is helpful in determining reaction mechanism.

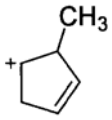
Or

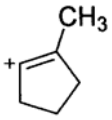
(b) (i) Define the principle of microscopic reversibility. (2+3)

(ii) Which of the following carbocation is the most stable? Give reasons.

(1) 

(2) 

(3) 

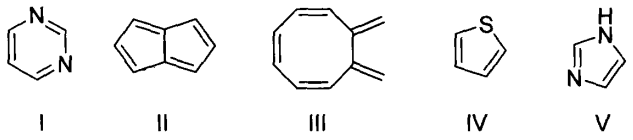
(4) 

12. (a) Discuss the various factors affecting nucleophilic substitution reaction.

Or

(b) Explain with examples (i) Hofmann's and Zaitsev's rule (ii) Bredts rule.

13. (a) Applying Huckel's rule predict whether the following compounds are aromatic or not.

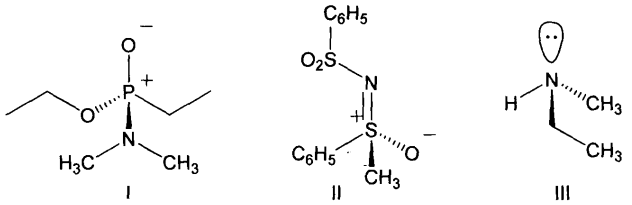


I II III IV V

Or

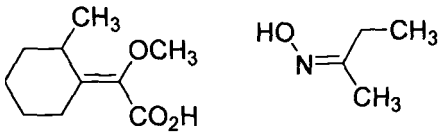
(b) Write a note on alternant and non-alternant hydrocarbons.

14. (a) (i) Assign absolute configuration to the stereogenic atoms in the following compounds: (3)



I II III

(ii) Assign E/Znomenclatureto the following compounds: (2)



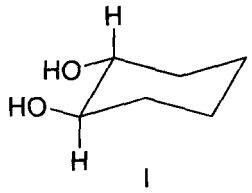
I II

Or

(b) (i) Select the correct stereochemical description of the relationship between the below pair of compounds? Support your answer. (3)

(1) Identical (2) Constitutional

(3) Enantiomers (4) Diasteroisomers



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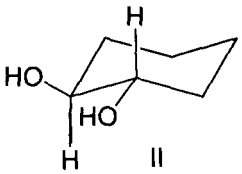

II

(ii) Write a note on the chirality of spiranes. Give examples. (2)

15. (a) Comment on the reactivity and stereoelectronic factors of cyclic systems with examples.

Or

(b) Elaborate the conformational analysis of *n*-butane.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. (a) Explain the primary kinetic isotope effect with an example. (5+5)

(b) How does the crossover experiment help in determining reaction mechanism?

17. Explain in detail the mechanisms of aliphatic electrophilic substitution.

18. (a) Discuss the utility of NMR for studying the aromaticity of annulenes. (5+5)

(b) Write a note on homoaromatic compounds.

19. Explain the various generations of asymmetric synthesis. Give examples for each.

20. Discuss the conformational analysis of 1,3-disubstituted cyclohexane.

R6041	Sub. Code
	538103

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Chemistry (spl in NST)

PHYSICAL CHEMISTRY–I

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Write about the inadequacy of classical mechanics.
2. Define angular momentum in quantum mechanics.
3. Discriminate between polarizable and non-polarizable interfaces.
4. State Tafel equation.
5. Discuss Arrhenius equation with its parameters.
6. Explain the activation energy for a composite reaction.
7. Mention any two need for second law of thermodynamics.
8. Describe activity coefficient for ideal gas.
9. Define chemiluminescence.
10. Give the working principle of photovoltaic cells.

Part B (5 × 5 = 25)

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

11. (a) Explain wave-particle duality by De-broglie hypothesis.

Or

(b) Discuss about the operators, linear operators and the Hermitian operators.

12. (a) Write about the types of electrode reactions.

Or

(b) Derive Lipmann equation by relating charge density and interfacial tension.

13. (a) Describe briefly about primary and secondary salt effects.

Or

(b) Deliberate a brief note on steady-state approximation.

14. (a) Discuss the phase diagram of water molecule.

Or

(b) Derive Gibbs-Duhem equation by using chemical potential of a substance.

15. (a) Explain the fluorescence quenching kinetics in solution phase.

Or

(b) Discuss the basic concept of photocatalysis.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. (a) Derive Schrodinger equation for hydrogen atom.

    (b) Explain the Born interpretation of the wave function. (5+5)

17. Derive Butler–Volmer equation.

18. Describe elaborately about the Lindemann- Hinshelwood mechanism for a unimolecular reaction.

19. Explain Debye-Huckel limiting law with its extensions.

20. Write about principle, working, instrumentation and uses of DSSC's

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R6042	Sub. Code
	538501

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Chemistry (Spl in NST)

INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** the questions.

1. Write any two benefits of nanotechnology.

2. What is top-down nanotechnology.

3. Define nanoparticle nucleation

4. What are reducing agent? Give suitable example.

5. What are zero dimensional nanoparticles?

6. List out the difference between the quantum dots and nanoparticles.

7. List out the various types of fullerene.

8. Define mesoporous and microporous materials.

9. What are Miller indices and give their significance?

10. List out the difference between space lattice and crystal lattice.

Part B (5 × 5 = 25)

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

11. (a) Deliberate the background and scientific revolutions of nanotechnology.

Or

(b) Explain with suitable examples of radical nanotechnology.

12. (a) Based on the suitable diagram, explain the homogeneous and heterogeneous nucleation processes involved in the formation of nanomaterials.

Or

(b) Write short note on solid state phase segregation.

13. (a) Discusses the preparation and unique properties of quantum wires.

Or

(b) On the basis of dimension, classify the nanomaterials.

14. (a) Describe the advantages of micro and mesoporous materials over the non-porous materials.

Or

(b) Write short note on intercalation compounds in nanoscience.

15. (a) Discuss the structures of supercondcutor materials.

Or

(b) Discuss about the electrical and electronic properties of nanomaterials.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Explain with suitable examples of misnomers and misconception of nanotechnology.

17. Explain the Ostwald ripening process in detail. How might be the surface area of nanomaterials tuned with the aid of Ostwald ripening process?

18. With the suitable examples, explain the use of CdS and ZnSe in semiconductor industries.

19. Explain the applications and various preparation methods involved in the fullerene's synthesis.

20. With the suitable examples, explain the physicochemical optical properties of nanomaterials.

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R6043	Sub. Code
	538301

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Chemistry (Spl. in Nanoscience and Tech.)

INORGANIC CHEMISTRY – III

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. How do you distinguish of bridge and terminal coordination carbon monoxide ligand using IR spectra?

2. What are necessary conditions of IR and Raman active? Mention two points.

3. Calculate number of microstates are possible for p^3 configuration.

4. What is the magnetic moment values of $\left[Co(NH_3)_6\right]^{+3}$ complex and $\left[CoF_6\right]^{-3}$ complex?

5. Define spin-spin splitting.

6. How many phosphorous resonance signals are absorbed in phosphorous and hyphophorous acids?

7. Why the energy transfer is greater in cyano chromium complexes than fluoro substituted complexes?

8. State the metralloprofein.

9. Define Wilson's disease.

10. List out any two reasons of quenching of ^{3}Me.

Part B $(5 \times 5 = 25)$

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

11. (a) Draw the ^{59}FE Mossbauer spectra of $\left[Fe(H_2O)_6\right]^{+2}$, $\left[Fe(CN)_6\right]^{-4}$ and $\left[Fe(CN)_5(NO)\right]^{-2}$ and sketches of their ligand-field splitting and discuss the quardruple splitting.

Or

(b) The ^{57}Fe spectrum of $\left[(C_5H_5)_2Fe\right]_2SnCl_2$ containing a single resonance for the solid and Frozen solutions. The ^{119}Sn spectrum of the solid is also a single resonance but there are two resonances in the spectrum of a frozen solution.

12. (a) What are the applications of Orgel diagram?

Or

(b) Describe the effect of temperature on magnetic susceptibility of ferromagnetic substance.

13. (a) How many isomers are possible in cyclic compounds $P_3N_3(CH_3)_2Cl_4$ and sketch the phosphorous resonance spectrum of each isomers.

Or

(b) What is meant by fluxinal molecules? Illustrate with the suitable examples.

14. (a) Write the mechanism of cleavage of water by ruthenium complexes?

Or

(b) What is meant by photoredox? Describe the photoreduction of $[Cr(\text{diimine})_3]^{+3}$ systems.

15. (a) Describe the mechanism of heterotropic allosteric effect of H^+ and cl^- on O_2 binding in haemoglobin.

Or

(b) Detail accounts of cyclic photophosphorylation process in photosynthesis.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. (a) Explain the linkage and geometrical of correlation complexes. (5)

(b) Account for the variation in the carbonyl stretching bends of the following compound:

$Co(2145cm^{-2})[M_n(Co)_6]^{+1}$ $(2090\ cm^{-1}), Cr(10)_6$ $(2000\ cm^{-1}); [V(Co)_6]^{-1}$ $(1860cm^{-1})$ (5)

17. How do you determine magnetic susceptibility magnetic moment of transition metal complexer?

18. Illustrate NMR studies of exchange reactions between ligands and metal ions.

19. Describe the ruthenium-sensitized photoelectro chemical solar cells.

20. Discuss the structural features haemoglobin and myoglobin.

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R6044	Sub. Code
	538302

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Chemistry (Spl in Nanoscience and Tech.)

ORGANIC CHEMISTRY – III

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** the questions.

1. Define photosensitization?'

2. Explain photoreduction with examples.

3. What are isotopic peaks?

4. State Beer-Lamberts law.

5. How will you correlate shielding and deshielding with downfield and upfield?

6. What is double resonance?

7. Write the structure of pyrrole. How will you synthesize it?

8. Write down Bischler-Napieralski synthesis of isoquinoline.

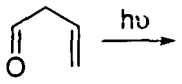
9. Define retron and partial-retron. Give example for each.

10. What do you mean by functional group transposition?

Part B (5 × 5 = 25)

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

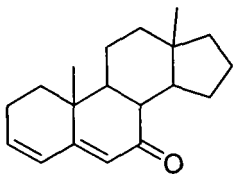
11. (a) Complete the reaction and give the mechanism.



Or

(b) Discuss the features of Jablonski diagram with a neat sketch.

12. (a) Calculate the λ max for the following compound



Or

(b) Comment on the retro Diels-Alder reaction in mass spectroscopy.

13. (a) What are the types of coupling in ^{1}H NMR? Give examples for each.

Or

(b) Explain the concept of chemical shift in NMR. What is shielding and deshielding?

14. (a) Discuss the mechanism of Paal-Knorr method to synthesize furan.

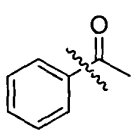
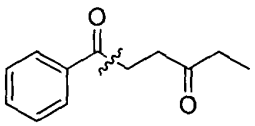
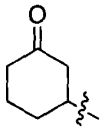
Or

(b) Comment on the mechanism of Hisenberg thiophene synthesis.

15. (a) Define the concept "umpolung" and illustrate its use in organic synthesis with examples.

Or

(b) Identify the synthons and synthetic equivalents corresponding to the disconnections shown on each of the molecules below. (1+2+2)

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Explain Norrish type I and II reactions with suitable examples.

17. (a) Comment on McLafferty rearrangement in mass spectroscopy. (5+5)

(b) Discuss the effect of conjugation on the vibrational frequency of alkene and carbonyl in JR spectroscopy.

18. Write notes on off-resonance decoupling and nuclear overhauser effect.

19. How will you prepare quinoline and indole? Give the mechanisms.

20. (a) Give one example each for chemoselective and regioselective protection reactions. (5+5)

(b) What do you mean by functional group interconversion in retrosynthesis? Explain with examples.

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R6045	Sub. Code
	538303

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Chemistry (Spl. in Nanoscience and Tech)

PHYSICAL CHEMISTRY — III

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Define shells and sub shells.
2. Define the specific selection rules of transition.
3. What is meant by symmetry and asymmetry rotation?
4. Define oblate and prolate.
5. What is meant by fuel cells?
6. State the primary battery.
7. What are the types of ensembles?
8. State Einstein condensation.
9. Illustrate the mixed valance of semiconductors.
10. Define superconductors. Give one example.

Part B (5 × 5 = 25)

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

11. (a) Illustrate the Droppler shifts and broadening spectra.

Or

(b) Explain the total orbital angular momentum.

12. (a) Write a short note on the convergence of energy levels.

Or

(b) Discuss the various types of branch transitions.

13. (a) How do you determine the corrosion rate by DC and AC methods? Which method is good for the measurements.

Or

(b) What is lithium in battery? Discuss the function and merit and demerits of the battery.

14. (a) Explain the Le Chalelier principle and sign of heat of enthalpy.

Or

(b) Define rotational partition function. Derive rotational partition function equation for linear molecules.

15. (a) Write a short notes on Frenkel defects in crystals.

Or

(b) Account the organic metals charge transfer complexes.

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. (a) Describe the orbital approximation for the wave function of a many electron atom. What are the limitations of the approximation? (5)

    (b) Deduce the ground state term symbols for d^2 electronic configuration. (5)

17. Detail accounts of Polarisation of light and Raman effect.

18. When $E \approx E_{corr}$? Discuss the various criteria of cathodic protection.

19. Derive the canonical partition function for :

    (a) Helmholtz energy (2)

    (b) The pressure (2)

    (c) The Gribbs energy. (6)

20. Explain various types of fuel cells.

R6046	Sub. Code
	538506

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

(Spl. in Nanoscience and Technology)

APPLICATIONS OF NANOTECHNOLOGY

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Write a full form of MEMS?

2. What is lithography?

3. Define Nanomedicine?

4. Give the short notes on Nanobiochip?

5. Define Lipid nanoparticle?

6. Write short notes on Drug Delivery

7. Explain short notes on Photocatalytic Decontamination?

8. Write the application of Fuel cell?

9. Write a full form of CNT?

10. . What is Micro Electronics?

Part B (5 × 5 = 25)

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

11. (a) Briefly note on Dip pen Lithography?

Or

(b) Write short notes on Pressure sensor?

12. (a) Write about the principle of Nanomedicine?

Or

(b) Write a short note on Nano arrays for diagnostics?

13. (a) Discuss about the Nanotechnology for Drug targeting?

Or

(b) Write about the Nanoparticles and Protein interaction?

14. (a) Give the notes on Degradation of Hazardous Organic pollution?

Or

(b) Explain the antibacterial activity by using nanomaterials?

15. (a) Describe the short notes on Nanoelectronics?

Or

(b) Explain the Size and Confinement Effects?

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. Give short notes on (a) Thermal Sensor, (b) Radiation Magnetic Sensor?

17. Give short notes on Nanoparticle delivery for Cancer therapy?

18. Give the accounts on Cell therapy?

19. Write the details about Chemical and Electrochemical sensor using nanomaterials?

20. Write about the short notes on CNT in electronic application

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