24MCHEH201 Reg No : .....

CHOICE BASED CREDIT SYSTEM

M.Sc. CHEMISTRY SECOND SEMESTER DEGREE EXAMINATION MAY 2025

Inorganic Chemistry Theory-II

Duration:3 Hours **Max Marks:70**

PART - A

1. Answer any TEN of the following : **(10×2= 20 Marks)**

a) Give the preparation of Isopolymolybdate.

b) Give the structure of tetracarbonyl cluster of Iridium.

c) What type of hybridisation is exhibited by N and B in Borazole?

d) What happens when
I) Chloric acid is distilled under reduced pressure
II) Ammonia reacts with dilute chlorine trifluoride

e) XeF_6 is cannot be stored in glass or quartz vessels. Justify by indicating reaction.

f) Give the structure of $FClO_3$ and explain.

g) Sc^{3+} is colourless but Ti^{3+} is coloured: Justify.

h) Why Nd^{3+} shows pink colour while Lu^{3+} is colourless?

i) Why Zn and Mn shows high standard electrode potential value(M^{3+}/M^{2+})?

j) The atomic weight of $^{84}_{36}Kr$ is 83.9115 amu. Calculate its binding energy.

k) Mention the condition for the nuclear stability based on number of protons and neutrons.

l) Why do very few inorganic polymers swell reversibly in the presence of a solvent?

PART - B

Answer any Five questions selecting at least one question from each unit (5×10= 50 Marks)

UNIT - I

2. a) On the basis of Wade's rule, calculate the number of electrons in the bonding molecular orbitals of the following and mention the class to which they belong:
i) $C_2B_5H_7$ ii) $C_2B_8H_{10}$ iii) $C_2B_{10}H_{12}$ iv) $C_3B_3H_7$ v) $C_2B_7H_{13}$ vi) B_8H_{16}
b) Explain the preparation and structure of $C_2B_{10}H_{12}$ (6+4)

3. a) Explain the structure of diborane on the basis of MOT.
   b) Draw the neat structure of B_5H_{11} and B_5H_9 (6+4)

UNIT - II

4. a) What do you know about Caro's acid and Marshall's acid? Discuss their preparation and properties.
   b) Explain the structures of $H_2S_2O_7$ and H_2SO_4 (6+4)

5. a) Give the structures of SO_2 and SO_3 molecules.
   b) Arrange H_2X (X=O, S, Se, Te, Po) compounds in order of increasing
   i) acidity ii) stability iii) boiling point iv) reducing character (6+4)

UNIT - III

6. a) Discuss the d-block elements in the following respect:
   i) Atomic radii ii) Ionization energy
   b) How do ionic radii of transition elements vary with atomic number in any series? (6+4)

7. a) Discuss briefly the following properties of actinides:
   i) Colour ii) Oxidation state iii) Ionic radii
   b) Write a short note on geometrical isomerism exhibited by coordination number 6. (6+4)

UNIT - IV

8. a) Describe in detail any five types of nuclear reactions.
   b) The amount of $^{14}_{6}C$ isotope in a piece of wood is found to be 1/6 of that present in a fresh piece of wood. Calculate the age of the wood. Half life of $^{14}_{6}C$ = 5577 years. (6+4)

9. a) Write a note on types of sheet silicates.
   b) Describe the properties of silicones. (5+5)

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24MCHEH202 Reg No : .....

CHOICE BASED CREDIT SYSTEM

M.Sc. CHEMISTRY SECOND SEMESTER DEGREE EXAMINATION MAY 2025

Organic Chemistry -II

Duration:3 Hours Max Marks:70

PART - A

1. Answer any TEN of the following : (10×2= 20 Marks)

a) What is Fries rearrangement?

b) What is meant by Ipso attack? Give an example.

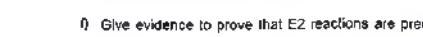
c) Present and explain energy profile diagram for the aromatic electrophilic substitution reaction.

d) Write the mechanism for E2 reaction.

e) Write a note on $B_{AC}2$ mechanism.

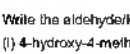
f) Give evidence to prove that E2 reactions are predominantly anti-eliminations and there is relation between conformation and reactivity.

g) Predict the products and name of the reaction:



h) Write the aldehyde/ketones from which following aldol are formed:
(i) 4-hydroxy-4-methyl-2-pentanone (ii) 2-Ethyl-3-hydroxy hexanal

i) Give the major and minor products of following reaction:



j) Write any two reactions of indole.

k) Write the reaction for alkylation and acylation of furan.

l) Give any 4 applications of Oxiranes.

PART - B

II. Answer any Five questions selecting at least one question from each unit (5×10= 50 Marks)

UNIT - I

2. a) Describe the orientation and reactivity of chlorobenzene towards electrophilic substitution reaction.

b) Write a note on Mannich reaction. (6+4)

3. a) Discuss the following: i) Pechman reaction ii) neighbouring group assistance in free radical reaction.
   b) Explain the mechanism of free radical substitution of an aromatic substrate. (6+4)

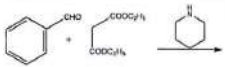
UNIT - II

4. a) Describe the Saytzeff rule. Justify the same with suitable examples.
   b) Explain the following: i) Chugaev reaction ii) Cope elimination (5+5)

5. a) Describe the Hoffmann rule taking suitable examples.
   b) Cis-2-alkylcyclohexylacetate forms a mixture of 1- and 3- substituted cyclohexene on pyrolytic elimination. Justify. (6+4)

UNIT - III

6. a) Discuss the mechanism of the following: i) Wittig reaction ii) Perkin reaction
   b) Predict the product and explain the mechanism: (6+4)



7. a) Discuss structural orientation and regioselectivity in electrophilic addition to carbon- carbon multiple bonds.
   b) Write a note on free radical addition reaction, taking suitable examples. (6+4)

UNIT - IV

8. a) Write the mechanism for the following synthetic methods:
      i) Bischler-Napieralski of isoquinoline ii) Doebner Miller of quinoline
   b) List the important reactions of quinoline and isoquinoline (5+5)

9. a) Describe the important methods for the synthesis of thiazole.
   b) Write the mechanism for the sulphonation and bromination reaction of thiazole. (6+4)

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22MCHEH202 Reg No : .....

CHOICE BASED CREDIT SYSTEM

M.Sc. CHEMISTRY SECOND SEMESTER DEGREE EXAMINATION MAY 2025

Organic Chemistry -II

Duration:3 Hours Max Marks:70

PART - A

1. Answer any TEN of the following : (10×2= 20 Marks)

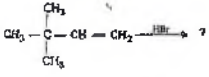
a) Give any one evidence which support aryne mechanism.

b) What is ipso attack? Give an example.

c) Why alkyl fluoride gives Hofmann elimination?

d) Predict the product and name the reaction:

e) Predict the products in the following:



f) What is meant by transesterification? Give an example.

g) Give the reaction for Gabriel ring closure synthesis of Aziridine.

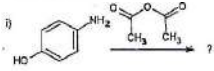
h) How thirane is prepared from oxiranes?

i) Give one reaction each for thiazole and thiophene.

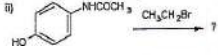
j) Predict the product for the following.

k) Predict the products for the following reactions:

i)



ii)



l) What is protecting group? Give an example.

PART - B

Answer any Five questions selecting at least one question from each unit (5×10= 50 Marks)

UNIT - I

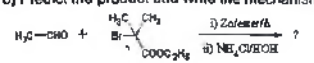
2. a) Explain orientation and reactivity in monosubstituted benzenes based on charge distribution.
   b) Discuss the mechanism of Sommelet-Hauser rearrangement. (6+4)

3. a) Explain the mechanism for E1, E2 and E1cb elimination reactions.
   b) Discuss the following: Cope elimination and Chugaev reaction (6+4)

UNIT - II

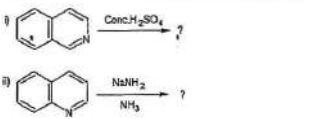
4. a) Write down and explain the products formed during the addition of HBr to 1-butene both in the presence and absence of peroxides.
   b) Write a note on addition reactions undergone by cyclopropane ring with suitable examples. (5+5)

5. a) Discuss the addition of Grignard reagent to carbonyl compounds and unsaturated carbonyl compounds
   b) Predict the product and write the mechanism for the following: (6+4)



UNIT - III

6. a) Describe the important methods for the synthesis of quinoline.
   b) Predict the product and write the suitable mechanism for the following:



(6+4)

7. a) Enumerate the synthetic methods for epoxide.
   b) Write the mechanism of Hantzsch synthesis for pyrrole. (6+4)

UNIT - IV

8. a) Write a note on microwave assisted organic synthesis.
   b) Describe the factors affecting the cavitation process in sonochemistry. (5+5)

9. a) Comment on the atom economy of following reactions:
      i) Elimination ii) Substitution iii) Rearrangement
   b) Enumerate the important principles of green chemistry (6+4)

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24MCHES203 Reg No : .....

CHOICE BASED CREDIT SYSTEM

M.Sc. CHEMISTRY SECOND SEMESTER DEGREE EXAMINATION MAY 2025

Spectroscopy-II

Duration:3 Hours Max Marks:70

PART - A

I. Answer any SEVEN of the following : (2×7= 14)

a) The proton decoupled ^{13}C NMR spectrum of tribromobenzene ($C_6H_3Br_3$) consists of two signals only. Which tribromobenzene is it?

b) How can you distinguish between ethanol (ordinary grade) and ethanol (pure)?

c) Why TMS is taken as reference compound in NMR?

d) Brief about meta stable peak in mass spectrum.

e) Comment on the salient features of the mass spectra of compounds containing two chlorine atoms.

f) Explain the mass spectra of 1-propanol

g) Write the process of sample preparation for Mossbauer spectroscopy.

h) Give the Equation for Zerofield splitting. What is the importance of **E** in the equation?

i) Define super hyperfine splitting. Give an example.

PART - B

II. Answer any Four questions selecting at least one question from each unit. (14×4 = 56)

UNIT - I

2) a) What is chemical shift? Discuss the various factors affecting the chemical shift in ^1H NMR spectroscopy.
b) Explain the following terms: (i) Shielding and deshielding (ii) Coupling constant
c) Calculate the multiplicity of methyl and methylene protons in case of ethyl chloride. (5+5+4)

3) a) Explain the ^1H NMR and ^{13}C NMR spectral feature in methyl ethyl ketone. For ^{13}C NMR consider both proton decoupled and off-resonance spectrum.
b) An organic compound gives the following spectral data: IR (cm^{-1}): 1730; ^1H NMR (δppm): 2.0 (3H, s), 2.93 (2H, t, J=7Hz), 4.30 (2H, t, J=7Hz), 7.3 (5H, s). Deduce the structure of the compound.
c) Describe the concept of DEPT in ^{13}C NMR. (5+5+4)

UNIT - II

4) a) Write some characteristic features of mass spectra of benzaldhyde and toluene. Show fragmentation patterns.

b) Two isomeric compounds A and B (molecular formula C_7H_8O) exhibit the following mass speactral data: Compound A: m/z 108, 93 (base peak), 78, 77, 65 and 51 Compound B: m/z 108, 107, 79 and 77. Deduce the structures of these compounds.

c) Write a note on: (i) magnetic sector analyser (ii) Chemical ionisation technique. (5+5+4)

5) a) Write important features of mass spectrum of alcohols. Show fragmentation patterns in primary, secondary and tertiary alcohols.

b) Identify the structure of the compound from the given data and interpret the data to the structure arrived at. Molecular formula: $C_5H_7NO_2$. ^1H NMR ($CDCl_3$) δ_{ppm} : 4.3 (quartet, 2H, J = 7.5 Hz), 3.5 (s, 2H), 1.3 (triplet, 3H, J = 7.5 Hz); ^{13}C NMR (CDCl3) δ_{ppm} : 165, 115, 62, 25, 15.

c) Explain the significance of metastable ions. How is the molecular mass of a metastable ion predicted? (5+5+4)

UNIT - III

6) a) Draw the energy level diagram and calculate NQR transition frequency for the nucleus having I =3/2 with an axially symmetric field.

b) Write a note on quadrupole moment in NQR Spectroscopy.

c) Explain the working mechanism of NQR spectrometer. (5+5+4)

7) a) Explain the Doppler effect and Mossbauer effect.

b) Write a note on Mossbauer nuclide.

c) Discuss the factors on which isomer shift values depend in Mossbauer Spectroscopy. (5+5+4)

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22MCHES203 (E) Reg No : .....

CHOICE BASED CREDIT SYSTEM

M.Sc. CHEMISTRY SECOND SEMESTER DEGREE EXAMINATION MAY 2026

Spectroscopy-I

Duration:3 Hours Max Marks:70

PART - A

1. Answer any SEVEN of the following : (7×2= 14)

a) Mention any two advantages and limitations of vibrational spectroscopy.

b) Sketch the vibrational energy levels of a diatomic molecule taking it as a simple harmonic oscillator.

c) Give the experimental set up of Raman spectrometer.

d) Benzene is colorless but its isomer Fulvene is yellow. How will you explain it?

e) How hydrogen bonding brings about a change in the position of absorption for a particular bond?

f) List out different modes of vibrations in CO_2.

g) Why Mossbauer spectrum for solid samples is recorded at low temperatures?

h) An irradiated sample of MgO has a strong ESR line at 0.163T when the spectrometer is operating at 9.4 GHz. What is the g value of the line?

i) Why ^{57}Co is used as a source in Mossbauer spectral study of iron compounds?

PART - B

II Answer any Four questions selecting at least one question from each unit. (4×14 = 56)

UNIT - I

2. a) Illustrate the classification of rotors.
b) Derive an expression for the intensities of the rotational spectral lines.
c) Outline the determination of the bond length of molecule from the rotational spectra? Explain how a rotational spectrum of a substance is obtained experimentally (5+5+4)

3. a) Describe the purpose of isotopic labelling in rotational spectroscopy.
b) The far infrared spectrum of HI consists of a series of equally spaced lines with change in wave number 12.8 cm^{-1}. What is a moment of inertia and the internuclear distance?
(mass of H atom is 1.008 amu and Mass of I atom 127 amu)
c) Discuss the applications of microwave spectroscopy. (5+5+4)

UNIT - II

4. a) Explain the order of backbonding, strength of CO bond and ν_{CO} stretching frequencies of the following complexes: $Ni(CO)_4$, $[Co(CO)_4]^-$ and $Fe(CO)_4]^{2-}$

   b) A complex of the metal M having the formula $[M(CO)_4(PMe_3)_2]$ exists in two isomeric forms. One shows four IR bands at 2016, 1915, 1900, 1890 cm^{-1}, where as the other shows only one strong band at 1890 cm^{-1}. Explain these data.

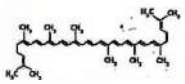
   c) Rationalise the stretching vibrations (cm^{-1}) of the metal nitrogen bond in 2,2' bipyridyl and 1,10 phenanthroline complexes of the following transition metals: (5+5+4)

M(II)	bipyridyl	o-phen
Fe(II)	423	530
Co(II)	264	268
Ni(II)	286	299
Cu(II)	297	300
Zn(II)	280	288

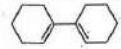
5. a) Explain the applications of UV visible spectroscopy.

   b) Calculate the λ_{max} for the following compounds using Fieser-Khun rule:

i) 

ii) 

   c) Following the Woodward - Fieser rules, calculate the absorption maximum for each of the following compounds : (5+5+4)

i) 

ii) 

UNIT - III

6. a) Illustrate the ESR spectrum of p-benzosemiquinone radical and benzene radical.

   b) Discuss the applications of ESR spectroscopy. Mention any two advantages and limitations of it.

   c) Write a note on zero field splitting in ESR spectroscopy. (5+5+4)

7. a) Draw the energy level diagram and calculate the NQR transition frequency for nucleus having I=7/2 with axially symmetric field.

b) Discuss the applications of NQR spectroscopy.

c) Write a note on quadrupole moment in NQR spectroscopy. (5+5+4)

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24MCHEE215 Reg No : .....

CHOICE BASED CREDIT SYSTEM

M.Sc. CHEMISTRY SECOND SEMESTER DEGREE EXAMINATION MAY 2025

Chemistry in everyday life

Duration:3 Hours **Max Marks:70**

PART - A

1. **Answer any SEVEN of the following :** **(2×7= 14)**

a) Why were Recommended Dietary Intakes (RDIs) introduced, and when were they first revised in India?

b) Give any two reasons for high risk pregnancies.

c) How does fibre help in digestion?

d) Name any two major minerals.

e) Give two important properties of protein.

f) What is the importance of cellulose in diet?

g) What is degumming in oil refining?

h) What is the chemistry of varnishes?

i) Mention any two preservatives that are used in the prepration of shampoo.

PART - B

II. Answer any Four questions selecting at least one question from each unit.

(14×4 = 56)

UNIT - I

2) a) Explain the concept of a balanced diet and its key components.
b) Explain their nutritional importance of fruits and vegetables. (7+7)

3) a) Discuss the importance of food in social and cultural life.
b) Why is it important to consider nutrient density when selecting foods? (7+7)

UNIT - II

4) Describe:
a) Different sources of vitamins
b) Various functions of vitamins (7+7)

5) a) Write a note on sources of fats.
b) Explain hydrogenation of oil.
c) Give an account on fatty acids. (5+5+4)

UNIT - III

6) a) Give a detailed study of the formulation and manufacture of lipstick.
b) Discuss the formulation and manufacturing of cream and lotion.
C) Explain the application and manufacture of nail polish. (5+5+4)

7) Write a note on the applications of the following :
a) Fatty acids and glycerol
b) Turkey red oil and
c) Greases. (5+5+4)

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