

2019(June)*Time : 3 hours**Maximum Weightage : 70%*

Candidates are required to give their answers in their own words as far as practicable.

The questions are of equal value.

*Answer **all** questions.*

1. With the help of VSEPR theory find out :
 - (a) Hybridization of centre atom
 - (b) Shapes and bond angle of the following molecule :
 - (i) XeO_3
 - (ii) BrF_5
 - (iii) ICl_3
 - (iv) ClO_3^-
 - (v) SO_3^{--}

OR

Explain the following :

- (a) Bond length of O_2 is more than that of O_2^+
- (b) Bent rule
- (c) $P\pi - d\pi$ bond

2. Why boranes are electron deficient explain ?
Discuss the structure of B_4H_{10} . Classify the
Dobson hydride.

OR

Construct the character table for C_{2v} point group.

3. Discuss liquid drop model for nuclear reaction.
Discuss the factors which regulates the nuclear
reaction.

OR

Draw MO diagram for CO and find out the bond
order. Show that CO is both donor and acceptor
ligand.

4. Discuss the chemistry of lanthanide with respect
to the following :
- (a) Position in P. T.

- (b) Oxidation state and stability
- (c) Lanthanide contraction

OR

Discuss the oxidation state of lanthanide
elements. How would you effect the separation of
lanthanide ion with the help of ion exchange
method.

5. Find out the symmetry elements in NF_3 and
assign their point group. Work out the group
multiplication table for C_{3v} point group.

OR

What do you mean by mathematical group ?
Prove that set of distinct symmetry operation
constitute a group in mathematical Deuce.



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1. What is aromaticity ? Discuss the aromaticity in benzenoid and non-benzenoid compound with suitable examples. 4+5+5 = 14

OR

State and explain Hyperconjugation in detail citing examples. 14

2. Discuss the conformation of cyclohexane why chair conformation is more stable than boat or twisted conformation. Draw the conformation of 1, 2, 1, 3 and 1, 4 dimethyl cyclohexane.

4+4+6 = 14

OR

Explain stereochemistry of biphenyls and spiranes. 8+6 = 14

3. Discuss the structure, stability and reactivity of carbocation. 4+4+6 = 14

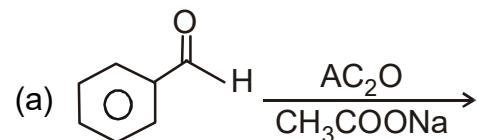
OR

Explain carbon free radicals with reference to generation, structure, stability and reactivity. 14

4. Write an account of any **two** of the following :
- (a) Hydroboration
 - (b) Mannich reaction
 - (c) Michael addition

OR

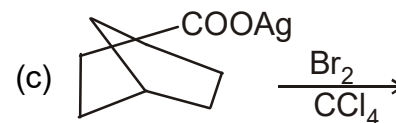
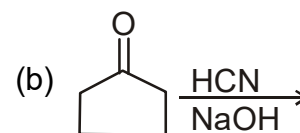
Predict the product giving the mechanism of any **two** of the following : 7×2 = 14



BZ – 321/1

(2)

Contd.



5. Discuss the stereochemistry of SN^2 and SN^1 nucleophilic substitution reaction. 7+7 = 14

OR

Write short notes on any **two** of the following :

- (a) Saytzeffi rule
- (b) Hofmann's rule
- (c) Carbene



BZ – 321/1 (125)

(3)

M. Sc.(I) — Ch (3)

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1. (a) What do you mean by Quantum mechanical operators ? Give their expressions.
- (b) Write down Time dependent Schrödinger wave equation. Derive from it time independent Schrödinger wave equation and concept of stationary states. 4+10 = 14

OR

- (c) Explain orthonormal functions. Illustrate with examples.
- (d) What do you mean by expectation value ?
State whether $\psi = \sin 2x$ is eigenfunction of

\hat{p}_x . If not, find out expectation value $\langle p_x \rangle$ in the limit of $-a \leq x \leq +a$. $6+8 = 14$

2. (a) Write down electronic Schrödinger wave function of one electron system in both Cartesian and polar form.

(b) Separate $R(r)$, $\Theta(\theta)$ and $\Phi(\phi)$ equations from above equation. $2+2+10 = 14$

OR

(c) Discuss radial wave functions and radial distribution functions.

(d) Find out most probable distance of electron from nucleus in H-atom and He^+ ion. $10+4 = 14$

3. (a) State and explain Eckart's Variation theorem.

(b) Derive secular equations and determinant using variation theorem. $7+7 = 14$

OR

(c) Explain Pauli's rule of antisymmetry of wave function. Discuss Spin-Orbitals.

(d) Write down Slater determinant of Li-atom. $7+7 = 14$

4. Discuss LCAO-MO method and apply to H_2^+ ion to obtain MO wave functions and energy eigenvalues. $4+5+5 = 14$

OR

Discuss Valence bond theory with special reference of H_2 molecule. Give the concept of resonance. $12+2 = 14$

5. Discuss HMO theory do deal with polyenes. Explain HMO wave-functions, energy levels, π electron density and π bond order. 14

OR

Apply HMO theory to butadiene to obtain :

$3 \times 4 = 14$

(a) HMO functions

(b) HMO energy

(c) π bond order

(d) π electron densities



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1. Discuss crystal field-theory and splitting of d-orbital in octahedral complexes of transition metals. What are its limitations.

OR

What do you mean by crystal field stabilization energy ? Calculate CFSE for d5, d6, d7 configuration.

2. What do you mean by “Spinel”, “Normal Spinel” and “Inverse Spinel” ? Find out the nature of Spinel in Cr_3O_4 .

OR

$\text{Cr}(\text{H}_2\text{O})_6$ shows three absorption bands at 17400 cm^{-1} , 24600 cm^{-1} and 37900 cm^{-1} . Assign the three bands and calculate Δ_0 and B^1 .

3. Differentiate between thermodynamic and kinetic stability of the complexes. Illustrate SN_1CB hydrolysis with example.

OR

Discuss the application of trans effect for the square planar $\text{Pt}(\text{II})$ complexes.

4. Discuss the various factors which regulates the crystal field splitting parameter relating magnitude of Dq and pairing energy effect. How magnetic moment effect, explain.

OR

What are selection rules for electronic absorption spectra and discuss relaxation in these rules.

5. Explain :

(a) Δt is only half as much as Δ_0

- (b) Magnetic moment of $\text{Cr}(\text{II})$ octahedral complexes may fall below μ_s value.

OR

Write notes on the following :

- (a) Charge transfer spectra
(b) Differentiate between high spin and low spin complexes with an example



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1. What are carbohydrates ? Establish the structure of sucrose by degradation and synthesis.

4+10 = 14

OR

What is glycosidic linkage ? Elucidate the constitution of maltose.

4+10 = 14

2. What are essential and non-essential fatty acids ? Discuss the structure and functions of triglycerides.

4+10 = 14

OR

What are amino acids ? Explain peptide bond. Explain primary and secondary structure of protein.

4+4+6 = 14

3. What are purine and pyrimidine derivatives of nucleic acids ? Explain the double helical model of DNA.

14

OR

Discuss the chemical and enzymatic hydrolysis of nucleic acid.

14

4. What are terpenoids ? Elucidate the structure of citral.

4+10 = 14

OR

Classify terpenoids. Discuss the structure of camphor by degradation and synthesis.

14

5. What are alkaloids ? Establish the structure of nicotine.

14

OR

Why is the physiological importance of alkaloids ? Discuss the constitution of Ppaverine.

14

