

2025

(FYUGP)

(1st Semester)

CHEMISTRY

(MINOR)

Paper Code : Chem.M-1 (T)

**(Inorganic Chemistry—I : Atomic Structure
and Chemical Bonding)**

Full Marks : 75

Pass Marks : 40%

Time : 3 hours

(PART : B—DESCRIPTIVE)

(Marks : 50)

*The figures in the margin indicate full marks
for the questions*

1. (a) Derive the expression for the energy of
an electron in Bohr's hydrogen atom. 2
- (b) Explain Heisenberg's uncertainty
principle. 2

(2)

- (c) Discuss the significance of ψ and ψ^2 . 2
- (d) Draw the radial distribution curve for the $2p$ orbital. 2
- (e) State Pauli's exclusion principle with an example. 2

OR

2. (a) Define and explain the de Broglie equation. 2
- (b) What is the significance of normalized and orthogonal wave functions? 3
- (c) Explain the shapes of p - and d -orbitals. 2
- (d) Discuss Hund's rule of maximum multiplicity. 3
3. (a) Explain the effective nuclear charge. 2
- (b) State and apply Slater's rules for $2p$ electrons in nitrogen. 3
- (c) Define covalent and van der Waals' radii. 2
- (d) Explain the periodic trend in atomic radii across a period. 2
- (e) Compare the atomic radius of Na and Mg. 1

26L/9a

(Continued)

(3)

OR

4. (a) Define ionization enthalpy. Explain the factors affecting ionization enthalpy. $1+2=3$
- (b) Why is the ionization enthalpy of nitrogen greater than that of oxygen? 3
- (c) Discuss the general trends of electron gain enthalpy across a period with examples. 4
5. (a) Define electronegativity. Explain how electronegativity varies with bond order. $1+2=3$
- (b) Discuss the variation of electronegativity with hybridization. 3
- (c) Compare the electronegativity of s - and p -block elements. 2
- (d) Write a short note on the periodicity of elements. 2

OR

6. (a) Explain the normality of a solution. Give an example. 3
- (b) Define the following : $1 \times 3 = 3$
- (i) Titration
- (ii) Oxidation
- (iii) Reduction

26L/9a

(Turn Over)

- (c) What is standard electrode potential? Explain the different types of electrode potential. 1+3=4

7. (a) Explain, in detail, the ionic character in covalent compounds. 3
 (b) Discuss the radius ratio rule. 4
 (c) Draw the MO diagram of CO, give its bond order and magnetic behaviour. 3

OR

8. (a) What is resonance? Draw the resonance structure of CO_3^{2-} and NO_3^- . 1+3=4
 (b) State the salient features of hybridization with examples. 3
 (c) Discuss solvation energy. 3
9. (a) What are the different types of intermolecular forces? 3
 (b) Differentiate between bonding and anti-bonding molecular orbitals. 4
 (c) Discuss the percentage ionic character from dipole moment and electronegativity difference. 3

OR

10. (a) Discuss the application of standard electrode potential to inorganic reactions. 4
 (b) Illustrate Born-Haber cycle by taking the example of the formation of NaCl(s). 4
 (c) What is Bent's rule? 2

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To be filled in by the Candidate

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1st Semester End Term
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Subject

Paper

INSTRUCTIONS TO CANDIDATES

1. The Booklet No. of this script should be quoted in the answer script meant for descriptive type questions and vice versa.
2. This paper should be ANSWERED FIRST and submitted within 1 (one) Hour of the commencement of the Examination.
3. While answering the questions of this booklet, any cutting, erasing, overwriting or furnishing more than one answer is prohibited. Any rough work, if required, should be done only on the main Answer Book. Instructions given in each question should be followed for answering that question only.

Signature of
Scrutiniser(s)

Signature of
Examiner(s)

Booklet No. A 1

Date Stamp

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Roll No.

Regn. No.

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DESCRIPTIVE TYPE

Booklet No. B

Signature of
Invigilator(s)

2025

(FYUGP)

(1st Semester)

CHEMISTRY

(MINOR)

Paper Code : Chem.M-1 (T)

**(Inorganic Chemistry—I : Atomic Structure
and Chemical Bonding)**

(PART : A—OBJECTIVE)

(Marks : 25)

The figures in the margin indicate full marks for the questions

Put a Tick (✓) mark against the correct answer in the
brackets provided :

1×15=15

1. The spectral lines in the hydrogen atom are
explained by

(a) Bohr's theory ()

(b) Dalton's theory ()

(c) Hund's rule ()

(d) Heisenberg principle ()

2. The probability interpretation of the wave function is given by

- (a) ψ ()
- (b) ψ^2 ()
- (c) $n + l$ rule ()
- (d) Pauli's principle ()

3. The shape of a d -orbital is

- (a) spherical ()
- (b) dumbbell ()
- (c) cloverleaf ()
- (d) linear ()

4. The effective nuclear charge can be calculated using

- (a) Pauli's principle ()
- (b) Slater's rules ()
- (c) Aufbau principle ()
- (d) Heisenberg principle ()

5. Which has the highest ionization enthalpy?

- (a) Li ()
- (b) Na ()
- (c) K ()
- (d) Cs ()

6. Electron gain enthalpy of halogen is generally

- (a) positive ()
- (b) negative ()
- (c) zero ()
- (d) variable ()

7. Electronegativity increases with

- (a) decreasing bond order ()
- (b) increasing bond order ()
- (c) increasing radius ()
- (d) increasing screening ()

8. Aufbau principle fails in

- (a) He atom ()
- (b) transition elements ()
- (c) noble gases ()
- (d) alkali metals ()

9. Which of the following is not a paramagnetic molecule?

- (a) C_2 ()
- (b) O_2 ()
- (c) N_2 ()
- (d) F_2 ()

10. Of the following species, which has the shortest bond length?

(a) NO ()

(b) NO⁻ ()

(c) NO⁺ ()

(d) NO²⁺ ()

11. The unusual high boiling point of H₂O is due to

(a) hydrogen bonding ()

(b) London forces ()

(c) van der Waals' force ()

(d) All of the above ()

12. For tetrahedral crystal, the radius ratio r^+/r^- should be

(a) 0.155–0.225 ()

(b) 0.225–0.414 ()

(c) 0.414–0.732 ()

(d) 0.732–1 ()

13. What is the hybridization involved in the formation of BF_3 molecule?

(a) sp ()

(b) sp^2 ()

(c) sp^3 ()

(d) sp^3d ()

14. In Born-Haber cycle, the symbol 'U' stands for

(a) ionization energy ()

(b) solvation energy ()

(c) dissociation energy ()

(d) lattice energy ()

15. Which of the following does not represent oxidation?

(a) Increase in positive charge of the atom or ion ()

(b) Decrease in negative charge of the atom or ion ()

(c) Loss of electrons by an atom, ion or group of atoms ()

(d) Increase in negative charge on the atom or ion undergoing reduction ()

Answer the following questions in brief : $2 \times 5 = 10$

1. Explain the difference between atomic radius and covalent radius.

2. Define shielding effect with an example.

3. State the limitations of Bohr's theory.

4. Define electrode potential.

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5. Distinguish between sigma and pi bonds.
