

Roll No.

Exam Code : D-23

Subject Code—60393

B. Sc. EXAMINATION

(Main/Reappear) (Batch 2019 Onwards)

(First Semester)

CHEMISTRY

CCL-104

Inorganic Chemistry-I (Atomic Structure
and Bonding)

Time : 3 Hours

Maximum Marks : 80

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. 1 is compulsory. All questions carry equal marks.

- (a) Can we apply Heisenberg's uncertainty principle to a stationary electron ?
- (b) Can we have 5 g subshell ?

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P.T.O.

(c) What are eigen values ?

(d) Arrange $3s$, $4d$ and $5p$ orbitals in terms of their $(n+l)$ rules.

(e) Define Resonance and Resonance energy.

(f) He_2 does not exist. Why ?

(g) What is bond order ? How is it related to stability of molecule ?

(h) Write molecular electronic configuration of O_2 and NO molecules. $8 \times 2 = 16$

$1s^2 2s^2 2p^6 3s^2 3p^4$

Unit I

ψ - wave function mathematical expression no physical significance

(a) What are limitations of Bohr's atomic theory ? ψ^2 - probability of finding e^- around nucleus

(b) Discuss the physical significance of ψ and ψ^2 .

(c) How will deduce de-Broglie's equation ?

3. (a) Explain Radial and Angular wave functions. On what quantum numbers do these depend ?

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(b) What are the conditions upon which ψ must satisfy to give meaningful solution ?

(c) A ball has a mass of 40 g and a speed of 45 m/s. If the speed can be measured within accuracy of 2%. Calculate the uncertainty in position.

Unit II

4. (a) What are quantum numbers ? Explain principal quantum number and Azimuthal quantum number.

(b) Draw and explain Radial probability distribution curves for $3s$ and $3d$ orbitals.

(c) Discuss the limitations of Aufbau principle.

5. (a) Explain Hund's rule of maximum multiplicity with an example.

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(b) Draw and discuss the shapes of $3d_{x^2-y^2}$ and $3d_{xy}$ orbitals. 5

(c) What can be maximum number of electrons in the orbitals $\frac{4d_{xy}}{10}, \frac{4p_z}{6}, \frac{3s}{2}, \frac{5f}{14}$ and $\frac{1s}{2}$? 5

Unit III

6. (a) Define Lattice Energy. Discuss various factors on which lattice energy of a crystal depends. 6
- (b) Calculate the percentage ionic character of HBr molecule its bond length is $1.41 \text{ \AA}$ and dipole moment = 0.78 D . 5
- (c) Give characteristics of Ionic Solids. 5
7. (a) On the basis of Hybridisation, discuss the shapes of the following molecules : 6
 - (i) XeF_4
 - (ii) SF_4
- (b) All the $p-d$ bonds are not equivalent. Explain. 5

(c) Anhydrous AlCl_3 is covalent but $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$ is ionic in nature. Explain. 5

Unit IV

8. (a) Explain on the basis of molecular orbital theory Bond order and magnetic properties of O_2 molecule. 6
- (b) Discuss the LCAO molecular orbital approach. 5
- (c) Predict the existence of H_2^- ion on the basis of molecular orbital theory. 5
9. (a) Give important differences between Bonding molecular orbitals and Antibonding molecular orbitals. 6
- (b) Explain rules for filling molecular orbitals. 5
- (c) Give similarities between valence bond theory and molecular orbitals theory. 5