

Name:	
Enrolment No:	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2018

Course: Inorganic Chemistry-I (CHEM-1003)

Semester: I

Program: B. Sc.(H)-Chemistry

Time: 03 hrs.

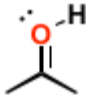
Max. Marks: 100

Instructions: Read all the below mentioned instructions carefully and follow them strictly

- 1) Write your Enrolment No. at the top left of the question paper
- 2) Do not write anything else on the question paper except your roll number
- 3) **Attempt all the parts of a question at one place only**
- 4) *Internal choice* are given for question numbers 9, 10 & 12

SECTION A

5 x 4 = 20 Marks

S. No.	All questions are compulsory	Marks	CO
Q 1	State metallic bonding in metals using Drude and Lorentz concept.	4	CO3
Q 2	Draw Lewis structures for the following molecules and predict the molecular geometry: i. BCl ₃ ii. XeO ₄	4	CO3
Q 3	Calculate formal charges of N, O atoms in the following molecules: i) $\text{—C}\equiv\text{N—H}$ ii)  iii) $\text{H}_3\text{C—C}\equiv\text{N—}\overset{\text{b}}{\underset{\cdot\cdot}{\text{O}}}\overset{\text{c}}{\cdot\cdot}$	4	CO3
Q 4	Differentiate between Electronegativity and Electron affinity.	4	CO2
Q 5	Give four possible quantum numbers for a 5f electron of the hydrogen atom.	4	CO1

SECTION B

5 x 8 = 40 Marks

Attempt all **FIVE** questions (Q 9 & 10 have internal **choice**)

Q 6	Write postulates of VSEPR theory and mention its limitations.	8	CO3
Q 7	a) Calculate the <i>p</i> character in the bonds of NH ₃ (bond angle is 107.5°) using Bent's equation to what is the <i>p</i> character of the lone pair? Given Cos (107.5°) = 0.7738 b) How many radial nodes do 3s, 4p, 3d and 5f orbitals exhibit?	4+4	CO3 CO1
Q 8	Which quantum numbers reveal information about the shape, energy, orientation, and size of orbitals? Explain	8	CO1
Q 9	Describe Allred-Rochow's scale of electronegativity with an example. OR Give brief description about Modern periodic table.	8	CO2
Q 10	Explain why He ₂ molecule does not exist and draw MOT energy profile diagram for	8	CO3

	B ₂ molecule. OR Explain the MOT energy profile diagrams for Li ₂ and NO molecules.		
SECTION-C		2 x 20 = 40 Marks	
Attempt TWO questions (Q 12 has internal choice)			
Q 11	<p>a) Estimate the lattice energy of NaCl using Born-Lande equation Where, <i>Avogadro constant</i> = $6.022 \times 10^{23} / \text{mol}$ <i>Madelung constant for the lattice</i> = 1.74756 <i>Elementary charge</i> = $1.6022 \times 10^{-19} \text{C}$ <i>Permittivity of free space</i> = $8.854 \times 10^{-12} \text{C}^2/\text{m}$ <i>Distance to closest ion</i> = $282 \times 10^{-12} \text{m}$ <i>'n' for NaCl molecule is 9.1</i></p> <p>b) Describe hydrogen bonding on basis of valence bond treatment.</p> <p>c) From the postulates of Bohr derive expression for radius of an atom?</p> <p>d) Determine the $\bar{\nu}$ for the transition wherein $n_1=6$ to $n_2 = 3$ in an hydrogen atom?</p>	5+5 + 6+4	CO3 CO1 CO1
Q 12	<p>a) Define polarizing power. What are the consequences of polarization in covalent character?</p> <p>b) Explain the defects in solids.</p> <p>c) Using Slater's rule calculate Z^* for the following electrons a) 3p electron in P b) 3d electron in Mn</p> <p style="text-align: center;">OR</p> <p>a) Describe Fajan's rules.</p> <p>b) Explain the types of weak chemical forces.</p> <p>c) Draw the angular wave functions of s, p, d and f orbitals by illustrating <i>gerade</i> and <i>ungerade</i> symmetry.</p>	5+5 +10	CO3 CO3 CO2

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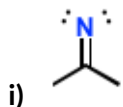
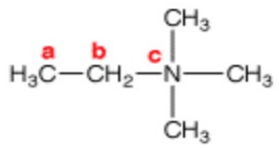
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SECTION A

5 x 4 = 20 Marks

S. No.	All questions are compulsory	Marks	CO
Q 1	Give four quantum numbers for each electron in Ti.	4	CO1
Q 2	Draw Lewis structures for the following molecules and predict the molecular geometry. Including expected distortions: i. ICl_2^+ ii. XeF_4	4	CO3
Q 3	Calculate formal charges of C and N atoms in the following molecules: i)  ii) 	4	CO3
Q 4	Write a short note on free electron theory.	4	CO3
Q 5	Which has higher 1 st ionization energy? i. Li or Cs? ii. Sc or Cu?	4	CO2

SECTION B

5 x 8 = 40 Marks

Attempt all **FIVE** questions (Q 9 & 10 have internal **choice**)

Q 6	Deduce structures of NH_3 , PH_3 , PF_3 , H_2O , H_2S , F_2O molecules according to VSEPR theory and explain hybridization for the same.	8	CO3
Q 7	Plot Radial probability functions graphs for $n=1, 2, 3$ for Hydrogen atom.	8	CO1
Q 8	Describe Pauling's scale of electronegativity with an example.	8	CO2

Q 9	From the postulates of Bohr, derive expression for radius of an atom. OR Write the postulates of Bohr's model for hydrogen atom.	8	CO1
Q 10	Explain LCAO concept and draw the MOT energy profile diagram for SF ₆ . OR Write main features of valence bond theory and explain the structures of C ₂ H ₆ molecule.	8	CO3
SECTION-C Attempt TWO questions (Q 12 has internal choice)		2 x 20 = 40 Marks	
Q 11	<p>a) Estimate the ionic radius of Cs⁺ using Born-Lande equation Where, <i>Avogadro constant</i> = $6.022 \times 10^{23} / \text{mol}$ <i>Madelung constant for the lattice</i> = 1.76267 <i>Elementary charge</i> = $1.6022 \times 10^{-19} \text{C}$ <i>Permittivity of free space</i> = $8.854 \times 10^{-12} \text{C}^2/\text{m}$ <i>the ionic radius of Cl⁻</i> = 1.81 Å <i>Lattice energy of CsCl</i> = 633 KJ/mol <i>'n' for CsCl molecule is 10.7</i></p> <p>b) Explain the types of semiconductors.</p> <p>c) Explain, Pauli's exclusion principle and Hund's rule used to specify electronic configuration of elements F, Mg, P and Ca.</p>	5 + 5 +10	CO3 CO3 CO2
Q 12	<p>a) Write Bent's rule and calculate the % <i>s</i> and % <i>p</i> character for CH₂F₂ and NH₃</p> <p>b) Explain the hydrogen bonding and weak chemical forces.</p> <p>c) Write the Slaters Rules for calculating shielding constant. Calculate affective nuclear charge of 4s electron of Cu.</p> <p style="text-align: center;">OR</p> <p>a) What are the physical properties of metallic bond and explain any two with examples?</p> <p>b) Describe the defects in metallic solids.</p> <p>c) How electronegativity and electron affinity does varies in a period and group? Mention the reason.</p>	5 + 5 +10	CO3 CO3 CO2