

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

Course: Inorganic Chemistry - I
Program: B. Sc. Chemistry
Course Code: CHEM 1003

Semester : I
Time 03 hrs.
Max. Marks: 100

Instruction: Answer all questions. All Questions are mandatory.

SECTION A

Each question will carry 4 marks

S. No.	Question	Marks	CO
Q 1	Write the complete electron configuration of following atomic numbers. $Z = 17, 24, 32,$ and 55	4	CO1
Q 2	(i) The first ionization enthalpy of sodium is lower than that of magnesium but its second ionization enthalpy is higher than that of magnesium, explain? (ii) Why HF is a liquid, whereas HCl is a gas?	4	CO2
Q 3	(i) Why water molecule has bent structure whereas carbon dioxide molecule is linear. (ii) Arrange the following bonds in order of increasing ionic character giving reason. N—H, F—H, C—H and O—H	4	CO2
Q 4	Predict the hybridisation of each carbon in the molecule given below. Also indicate the total number of sigma and pi bonds in this molecule. $\begin{array}{ccccccc} & & \text{O} & & & \text{O} & \\ & & & & & // & \\ \text{CH} & \equiv & \text{C} & - & \text{C} & - & \text{CH}_2 & - & \text{C} & & \text{OH} \\ 5 & & 4 & & 3 & & 2 & & 1 & & \end{array}$	4	CO3
Q 5	Calculate the percentage ionic character of H-Cl bond in HCl molecule. If the experimental value of dipole moment (μ) is 1.03 D. Given that $e = 4.80 \times 10^{-10} \text{ e.s.u.}$ and the bond length of H-Cl is 1.27 \AA .	4	CO3

SECTION B

Each question will carry 10 marks

Q 6	Derive the Schrodinger wave equation? What is the significance of Ψ and Ψ^2 ? OR	10	CO1
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	<p>(i) Find out the value of frequency (ν) of radiation emitted when an electron falls from $n = 4$ to $n = 1$ orbit in H-atom. Given : Ionization energy (IE) of H-atom = 2.18×10^{-18} J/atom and $h = 6.625 \times 10^{-34}$ Js.</p> <p>(ii) Discuss Bohr's model of the atom. How does it account for the hydrogen spectra? What are its limitations?</p>		
Q 7	<p>(i) Write short notes on (a) Fajan's rule, and (b) Radius Ratio rule</p> <p>(ii) Calculate the electron affinity of Chlorine using the following data:</p> <p>Enthalpy of formation of NaCl = -411 kJ/mole</p> <p>Lattice Energy of NaCl = -787 kJ/mole</p> <p>Ionization enthalpy of Na = 496 kJ/mole</p> <p>Dissociation energy (Cl_2) = 121.7 kJ/mole</p> <p>Sublimation energy (Na metal) = 107.7 kJ/mole</p>	5+5	CO3
Q 8	<p>(i) Using band theory, explain the conductivity of metals and semiconductors.</p> <p>(ii) What are the postulates of valence bond theory, explain?</p>	10	CO3
Q 9	<p>(i) What is electronegativity? Explain the factors affecting the magnitude of electronegativity.</p> <p>(ii) Covalent radius of F is 0.72 \AA. Calculate its Allred-Rochow's electronegativity to nearest integer.</p>	10	CO2
SECTION-C			
Each question carries 20 marks			
Q 10	<p>(i) What is effective nuclear charge? How does screening constant (σ) vary in the periodic table? Calculate the effective nuclear charge of the valence electron for atomic number 19 and 23.</p> <p>(ii) In each of the following pairs of compounds, which one is more covalent and why?</p> <p>(a) AgCl, AgI (b) BeCl_2, MgCl_2 (c) SnCl_2, SnCl_4 (d) CuO, CuS</p> <p style="text-align: center;">OR</p> <p>(i) Deduce the shapes of following molecules using VSEPR theory and predict the hybridization and bond angle in each case. (a) BF_3 (b) NH_3 (c) H_2O (d) ICl_2^- (e) SO_4^{2-}.</p> <p>(ii) Explain the formation of ionic bonding and covalent bonding. Compare the properties of ionic compounds and covalent compounds.</p>	10+10	CO2
Q 11	<p>(i) Draw molecular orbital diagram of CO and NO. Calculate their bond order and comment on their magnetic property.</p> <p>(ii) What is hydrogen bonding and its significance? Using examples explain different types of hydrogen bonding.</p>	12+8	CO3