UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

Course: Inorganic Chemistry I
Program: B.Sc. (H) Chemistry
Course Code: CHEM 1003

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

Instructions: Attempt all the questions.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain the main postulates of Pauling-Slater theory of covalent bonds.	4	CO3
Q 2	Draw the Lewis structures of: i) IF_7 ii) $BeCl_2$	4	CO4
Q 3	Compare between ionic and covalent compounds.	4	CO4
Q 4	Give reasons: i) HCl is gas whereas HF is liquid. ii) When two ice cubes are pressed over each other, they unite to form one cube.	4	CO3
Q 5	Write the resonating structures of NO_2 and CO_3^{2-}.	4	CO4

SECTION B
(4Qx10M= 40 Marks)

Q 6	Explain the following, giving reason: i) $BaSO_4$ is very less soluble in water. ii) Sulphur forms two types of oxides viz. SO_2 and SO_3. iii) CO_2 has no dipole moment but SO_2 does.	3+4+3	CO3
Q 7	a) On the basis of Hanmay and Smith equation, calculate the % of ionic character in LiF, LiCl, LiBr and LiI molecules. Given Electronegativity of F = 4.0 Electronegativity of Cl = 3.2 Electronegativity of Br = 3.0 Electronegativity of I = 2.7 Electronegativity of Li = 0.8 b) Which of the following compounds have co-ordinate bonds: BF_3, O_3, PCl_5, SF_6, IF_7, NH_4Cl	7+3	CO3

Q 8	Arrange the following as instructed. Give reason also to support your answer.
	    i) $(CH_3)_3N$, PH_3, NH_3 (increasing order of melting point)
	    ii) BF_3, AlF_3, GaF_3, InF_3 (increasing order of covalent character)
	    iii) o-dibromobenzene, m-dibromobenzene, p-dibromobenzene
	          (increasing order of dipole moment)
	
	OR
	
	Discuss the electronic configuration (using MO diagram), bond order and magnetic behavior of the following molecules:
	    i) C_2
	    ii) O_2
	    iii) NO
		3+3+4	**CO3**

Q 9	a) Use the following data for the given reactions and calculate the value of lattice energy of $CaBr_2$.
	    i) $Ca_{(s)} + F_{2\,(g)} \rightarrow CaF_{2\,(s)}$, $\Delta H = -575.0\ kJ/mole$
	    ii) $Ca_{(s)} \rightarrow Ca_{(g)}$, $\Delta H = 178.0\ kJ/mole$
	    iii) $Ca_{(g)} \rightarrow Ca^{++}_{(g)} + 2e^-$, $\Delta H = 1735.0\ kJ/mole$
	    iv) $F_{2(g)} \rightarrow 2F_{(g)}$ $\Delta H = 353.0\ kJ/mole$
	    v) $F_{(g)} + e^- \rightarrow F^-_{(g)}$ $\Delta H = -450.0\ kJ/mole$
	
	b) NaCl solution gives white precipitate with $AgNO_3$ solution but CCl_4 does not give. Why?
		7+3	**CO3**

SECTION-C **(2Qx20M=40 Marks)**		

Q 10	a) i) Discuss the radial probability distribution curve of 1s, 2s and 3s orbital.
	    ii) What quantum numbers would you assign to the last electron of Rb-atom (Z = 37) as well as its 30th electron?
	b) i) Write the expression of time independent Schrodinger equation. Write the expression of Hamiltonian operator in one dimension.
	    ii) A radiation of wavelength 200 nm falls on a cesium metal surface. Calculate the velocity of the electron ejected from the metal surface given that the minimum energy required for such ejection is 8×10^{-19} J.
	OR
	
	    i) What do you mean by dual nature of matter? Show that de Broglie waves can be used to explain the Bohr model
	    ii) Distinguish between electron affinity and electronegativity.
		10+10
		
		10+10
			CO1

| Q 11 | i) | Discuss the Slater's Rules for calculating screening constant (σ) and effective nuclear charge (Z_{eff}). | **10+10** | **CO2** |
| | ii) | Explain Pauli's exclusion, Hund's rule of maximum spin multiplicity and Aufbau principle with example. | | |