



DOON UNIVERSITY, DEHRADUN

End Semester Examination, First (Odd) Semester, 2016–2017

Department of Chemistry, School of Physical Sciences (SoPS)

Integrated M.Sc. 5 Years (Chemistry)

Course: Inorganic Chemistry–I

Course Code: CYC–101

Time Allowed: 03 Hours

Maximum Marks: 30

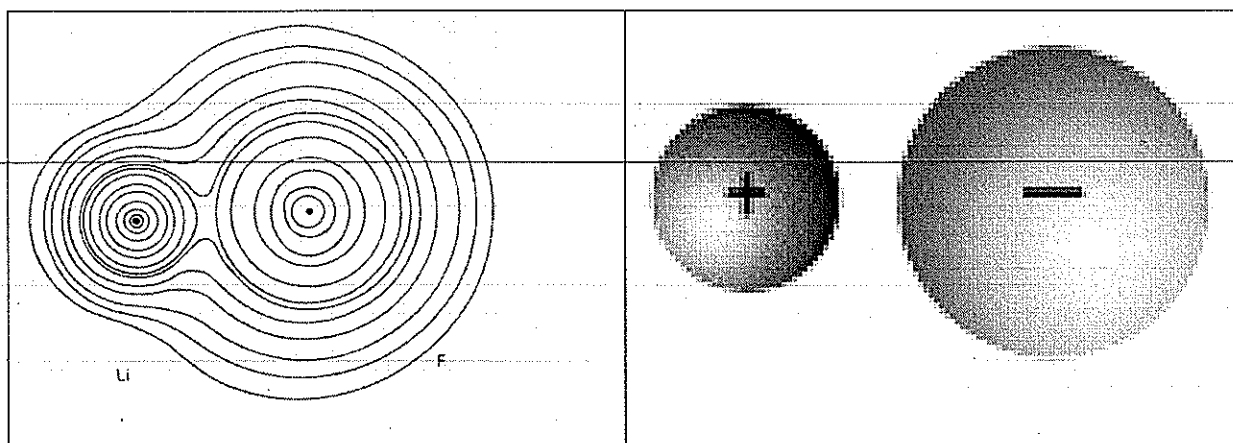
Note: Attempt All Questions from Sections A, B and C.

SECTION: A

(Marks: 6 Q × 1 = 6)

[1] Explain the phenomenon in following images:

[1]



[2] Carbon can form two oxides. Name the two oxides and draw their electronic structures.

[1]

[3] Estimate the % ionic character of H–Cl bond by dipole moment. Given that dipole moment is 3.689×10^{-30} Coulomb meter, bond length is 1.284×10^{-10} (meter) and electronic charge, $e = 1.602 \times 10^{-19}$ Coulomb

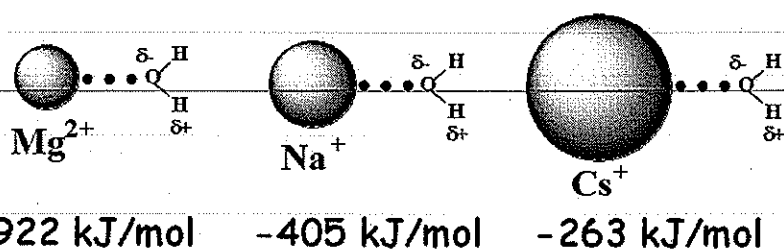
[1]

- [4] Describe and explain the general periodic trend of atomic radius of elements in the Periodic Table. [1]
- [5] Why are silver halides more covalent than sodium halides? [1]
- [6] Why do Group I carbonates have higher solubility in water than other carbonates? [1]

SECTION: B

Marks: 12

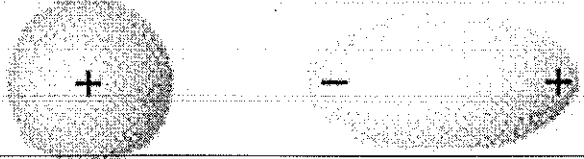
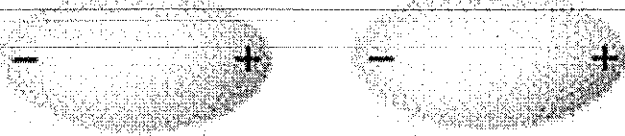
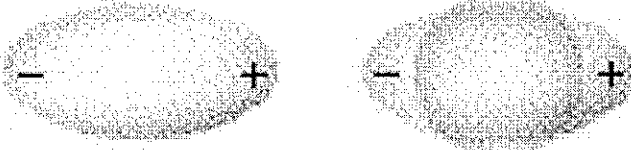

- [7] (a) Explain the reason for difference in boiling points of following sets of molecules: [1]
- (i) Boiling Point : O_2 $-183.0^\circ C$ / N_2 $-195.6^\circ C$
- (ii) Boiling Point : Kr $-152.9^\circ C$ / Ne $-245.9^\circ C$
- (iii) Boiling Point : Cl_2 $-34.6^\circ C$ / F_2 $-187^\circ C$
- (iv) Boiling Point : C_4H_{10} $-0.5^\circ C$ / C_3H_8 $-42.1^\circ C$
- (b) Among four different silver halides, solubility of silver fluoride is maximum in water and solubility of silver iodide is minimum in water. Explain the reason. [1]
- (c) Write a short note on additivity rule. [1]
- [8] (a) To which type of oxide does each of the following oxides belong? [2]
- (i) Magnesium oxide (ii) Nitrogen monoxide
- (iii) Silicon dioxide (iv) Aluminium oxide
- (b) Describe the type and details of intermolecular forces in the following molecules: Ne, Kr, H_2 , O_2 , N_2 , S_8 , C_3H_8 , CCl_4 , CO_2 . [1]
- [9] (a) Comment on the following and explain with justification: [1]



- (b) Explain Fajan's Rule in detail. [2]
- [10] (a) Iodine is a solid at room temperature whereas F_2 is a gas. Explain the reason. [1]
- (b) Consider the following data $E(H-H) = 436 \text{ kJ mol}^{-1}$, $E(F-F) = 158 \text{ kJ mol}^{-1}$, $E(H-F) = 565 \text{ kJ mol}^{-1}$, $E(Cl-Cl) = 242 \text{ kJ mol}^{-1}$, $E(H-Cl) = 431 \text{ kJ mol}^{-1}$. Calculate the electronegativity values of H and Cl. Given that electronegativity of Fluorine is 4.0. [2]

[11] (a) Fill the blanks:

[2]

	<i>Principle Factors responsible for Interaction Energy is/are:</i> Examples:.....
Type of Interaction:	
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Type of Interaction:	
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Type of Interaction:	
	<i>Principle Factors responsible for Interaction Energy is/are:</i> Examples:.....
Type of Interaction:	

(b) Explain the following phenomena:

[2]

- (i) PCl_3 is polar but BCl_3 is non-polar.
- (ii) Both NBr_3 and NF_3 are polar but their molecules align differently in a non-uniform electrostatic field.

(c) The following gives the theoretical and experimental values of the lattice enthalpies of two metal bromides. X^+Br^- and Y^+Br^- . Explain the reason for a high degree of agreement

Compound	Theoretical lattice enthalpy (kJ mol ⁻¹)	Experimental lattice enthalpy (kJ mol ⁻¹)
X ⁺ Br ⁻ (s)	-665	-670
Y ⁺ Br ⁻ (s)	-758	-890

between the theoretical and experimental values in the case of X⁺Br⁻ (s) but a large discrepancy in the case of Y⁺Br⁻ (s). Also describe which group in the Periodic Table does metal X possibly belong? [2]

[12] (a) Observe the data described in following tables carefully:

Compound	Lattice enthalpy (kJ mol ⁻¹)		
	Theoretical	Experimental	% deviation
NaCl	-766.1	-766.4	
NaBr	-730.5	-733.0	
NaI	-685.7	-688.3	
KCl	-692.0	-697.8	
KBr	-666.5	-672.3	
KI	-630.9	-631.8	

Compound	Lattice enthalpy (kJ mol ⁻¹)		
	Theoretical	Experimental	% deviation
AgCl	-833.0	-890.0	
AgBr	-808.0	-877.0	
AgI	-774.0	-867.0	
Zns	-3427.0	-3615.0	

Calculate the value of % deviation for all the compounds described in both the tables and correlate the same on the basis of type of compounds. Also write down your inference. [4]

(b) Give the shapes and structural formulae of the following molecules. State whether each molecule is polar or non-polar: (i) BCl₃ (ii) NH₃ (iii) CHCl₃ [1]

(c) How many factors are responsible for the presence of dipole moment in a molecule? Explain with examples. [1]