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3 (Sem-1/CBCS) CHE HC 1

2023

**CHEMISTRY**

(Honours Core)

Paper : CHE-HC-1016

**(Inorganic Chemistry-I)**

Full Marks : 60

Time : Three hours

***The figures in the margin indicate  
full marks for the questions.***

1. Answer ***all*** questions from the following :

1×7=7

- (a) An electron is present in the valence shell of Lithium. Write all possible values of  $n$ ,  $l$ ,  $m$  and  $s$ .
- (b) Arrange the following in decreasing order of their ionic character

$HF$ ,  $HI$ ,  $HCl$ ,  $HBr$

Contd.



- (c) Choose the correct answer :

Geometry of  $ClF_3$  is

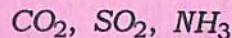
- (i) Tetrahedral
- (ii) Pyramidal
- (iii) Trigonal planar
- (iv) T-shaped

- (d) In the reaction



predict the oxidising and reducing agent.

- (e) Which of the following molecules are polar ?



- (f) Name the region of electromagnetic spectrum in which Lyman series lie.
- (g) Name *two* defects in stoichiometric compounds.

2. Answer **all** questions from the following :  
2×4=8

- (a) Explain the following reactions in the light of group electronegativity.



- (b) What do you mean by well-behaved function ?
- (c) With the help of VSEPR theory predict the shape of the following molecules
  - (i)  $H_2O$
  - (ii)  $XeF_4$
- (d) State Heisenberg's uncertainty principle and give the mathematical form of the principle.

3. Answer **any three** questions from the following :  
5×3=15

- (a) Define electron affinity. Explain the factors on which it depends. Why N has negative electron affinity ?

$$1+3+1=5$$

(b) Explain disproportionation reaction?  
Will  $\text{Cu}^{2+}$  undergo disproportionation in an aqueous solution? Discuss.  $2+3=5$

(c) What is Born-Haber cycle? How is it used to calculate the lattice energy of  $\text{NaCl}$ ?  $1+4=5$

(d) (i) The dipole moment of  $\text{HF}$  molecule is  $1.91\text{D}$ . Calculate the per cent ionic character in  $\text{HF}$ . (Bond length of  $\text{HF} = 0.92\text{\AA}$ ) 3

(ii) Explain why  $\text{NaCl}$  is water soluble but  $\text{NaI}$  is not. 2

(e) What is polarisation in ionic compounds? Which of the following will exhibit the greater polarising power? Give reason.  $2+3=5$

(i)  $\text{K}^+$  or  $\text{Ag}^+$

(ii)  $\text{K}^+$  or  $\text{Li}^+$

(iii)  $\text{Tl}^{2+}$  or  $\text{Tl}^{4+}$

4. Answer **any three** questions from the following :  $10 \times 3 = 30$

(a) (i) What do you mean by de-Broglie wavelength? 1

(ii) Describe the experimental verification of de-Broglie equation. 4

(iii) What are the significance of Heisenberg's Uncertainty Principle? 2

(iv) Calculate the uncertainty in the position of an electron moving with a velocity of  $300\text{ ms}^{-1}$  along with an accuracy of  $0.001\%$ . 3

(b) (i) Discuss the physical significance of each quantum numbers.  $1^{1/2} \times 4 = 6$

(ii) 's-orbital has spherical shape'. Explain the comment on the basis of Angular wave function. 3

(iii) How many quantum numbers are obtained from Schrödinger equation? 1

(c) (i) What do you understand by the terms Bonding and Antibonding molecular orbital? Draw the electron charge density diagram for each.  $2+2=4$

(ii) Write the MO electron configuration for the  $\text{NO}^-$  ion. What is the bond order? Will the bond length be shorter or longer than in  $\text{NO}$ ? Will the unpaired electrons be concentrated more on the N or O? Explain.  $2+1+1+2=6$

(d) (i) Define atomic and ionic radii. How do atomic radii vary in groups and periods?  $2+4=6$

(ii) What are isoelectronic ions? How effective nuclear charge affects the  $\text{Na}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{F}^-$ ,  $\text{O}^{2-}$ ? Arrange them in increasing order of size.  $1+2+1=4$

(e) (i) What do you mean by equivalent hybrid orbital? Give example.  $1+1=2$

(ii) What shapes are associated with the molecules involving  $sp^2$  and  $sp^3d^2$  hybridisation? 1

(iii) Explain Bent's rule. 3

(iv) What is radial node? Draw radial wave function of 2s and 3p orbitals. Predict the number of radial nodes for each.  $1+2+1=4$

(f) Write about the following :

(i) Band theory 5

(ii) Hydrogen Bond 3

(iii) Normality of a solution 2