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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

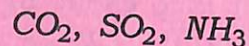
(iv) T-shaped

(d) In the reaction



predict the oxidising and reducing agent.

(e) Which of the following molecules are polar ?



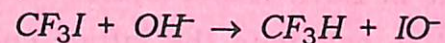
(f) Name the region of electromagnetic spectrum in which Lyman series lie.

(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



(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 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 NaCl ?
 $1+4=5$

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

(ii) Explain why NaCl is water soluble but 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) K^+ or Ag^+

(ii) K^+ or Li^+

(iii) Ti^{2+} or Ti^{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 ms^{-1} along with an accuracy of 0.001% .
3

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

(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 NO^- ion. What is the bond order? Will the bond length be shorter or longer than in 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 Na^+ , Mg^{2+} , Al^{3+} , F^- , 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