

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



B.Sc. DEGREE EXAMINATION – CHEMISTRY

FIRST SEMESTER – NOVEMBER 2022

UCH 1501 – BASIC CONCEPTS IN INORGANIC CHEMISTRY

Date: 24-11-2022

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

SECTION - A

Answer ALL the Questions in one or two sentences

1.	Fill in the blanks	(5 x 1 = 5)	
a)	The amount of energy released when an isolated gaseous atom captures an electron is known as _____.	K1	CO1
b)	Addition of an electron is known as _____.	K1	CO1
c)	Electronegativity of fluorine is _____ than chlorine.	K1	CO1
d)	Atomic orbitals which have the symmetry about the bond axis are called _____.	K1	CO1
e)	Molecular formula of bleaching powder is _____.	K1	CO1
2.	Choose the correct answer for the following	(5 x 1 = 5)	
a)	The correct electronic configuration for chromium atom is _____ (i) $1s^2 2s^2 3s^2 2p^6 3p^6 4s^1 3d^5$ (ii) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^4$ (iii) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$ (iv) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4 4s^2$	K1	CO1
b)	The conjugate acid of OH ⁻ in the following reaction is: $\text{NH}_4^+ + \text{OH}^- \rightarrow \text{NH}_3 + \text{H}_2\text{O}$ (i) NH ₃ (ii) H ₂ O (iii) NH ₄ ⁺ (iv) OH ⁻	K1	CO1
c)	The shape of XeF ₄ is (i) tetrahedral (ii) square planar (iii) triangle (iv) circle	K1	CO1
d)	Which is not the characteristics of metallic bonds? (i) strength (ii) ductility (iii) lustre (iv) non-conductors of electricity	K1	CO1
e)	The most important oxidation state of chlorine is (i) -1 (ii) +1 (iii) +III (iv) +V	K1	CO1
3.	Match the following	(5 x 1 = 5)	
a)	Hard acid -- reduction reaction	K2	CO1
b)	Hard base -- Pb and Tl	K2	CO1
c)	Sodium in liq. NH ₃ -- CO and O ₂ ²⁺	K2	CO1
d)	Inert pair effect -- H ⁺ and Li ⁺	K2	CO1
e)	Isoelectronic species -- NH ₃ and H ₂ O	K2	CO1
4.	Define the following	(5 x 1 = 5)	
a)	Ionic radii	K2	CO1
b)	Aprotic solvents	K2	CO1

c)	Hybrid orbitals	K2	CO1
d)	Conduction band	K2	CO1
e)	Pseudohalides	K2	CO1
SECTION - B			
Answer any TWO of the following			(2 x 10 = 20)
5.	(a)	Illustrate the variation of electron affinity and covalent radii of elements in the periodic table.	(5) K3 CO2
	(b)	How does de-Broglie concept explain the duality of electrons. Calculate the de Broglie wavelength of an electron travelling at velocity 50 m/s.	(5) K3 CO2
6.	(a)	Determine the oxidation number of S and O in $S_3O_6^{2-}$ and $S_2O_3^{2-}$.	(4) K3 CO2
	(b)	Show that water is a levelling solvent and acetic acid is a differentiating solvent for protonic acids.	(6) K3 CO2
7.	(a)	Draw the Lewis electron dot structures of the following molecules. i) CO_2 ii) H_2O iii) Cl_2	(5) K3 CO2
	(b)	Compare Sidgwick-Powell theory with VSEPR theory.	(5) K3 CO2
8.	(a)	Discuss the preparation, any two properties and structure of I_2O_5 .	(5) K3 CO2
	(b)	Apply any one theory of bonding to predict the structure of (i) ClF and (ii) ClF_3 .	(5) K3 CO2
SECTION - C			
Answer any TWO of the following			(2 x 10 = 20)
9.	(a)	Analyse the significance of Mulliken's method in measuring the electronegativity of the atom.	(5) K4 CO3
	(b)	Explain the following: (i) isoelectronic molecules (ii) inert pair effect	(5) K4 CO3
10.	(a)	Compare the merits and demerits of Arrhenius and Usanovich theories for acids and bases.	(5) K4 CO3
	(b)	Analyse liquid ammonia as an effective non-aqueous solvent for (i) precipitation reactions (ii) acid base reaction.	(5) K4 CO3
11.	(a)	Compare the structure and shape of SF_6 and XeF_4 using VSEPR theory.	(6) K4 CO3
	(b)	Predict the products for the following reactions: (i) $Cl_2 + NaOH \rightarrow ?$ (ii) $ClF_3 + MgO \rightarrow ?$	(4) K4 CO3
12.	(a)	Distinguish the n-type semiconductor from p-type semiconductor. Cite an example for each.	(5) K4 CO3
	(b)	Compare the stability and bond order of He_2 and Be_2 molecules with the help of MO theory.	(5) K4 CO3

SECTION - D

Answer any ONE of the following

(1 x 20 = 20)

13.	(a)	Summarize the salient features of modern periodic table.	(5)	K5	CO4
	(b)	Using the postulates of valence bond theory, explain the geometry of BX_3 molecule, where $X = F$ or Cl	(5)	K5	CO4
	(c)	State HSAB principle. With the help of HSAB principle, predict (i) the feasibility of reaction between LiI and CsF and (ii) stability of compounds.	(10)	K5	CO4
14.	(a)	Write a method of preparation of $HOCl$ and $HClO_2$ and indicate the oxidation state of chlorine in these compounds.	(4)	K5	CO4
	(b)	Justify the following statements with the suitable examples: (i) Multiple bonds do not grossly influence the geometry of a molecular species. (ii) Lone pair of electrons repel the neighbouring electron pairs more strongly than bond pair of electrons.	(6)	K5	CO4
	(c)	Evaluate the bond order, stability and magnetic properties of CO molecule using the qualitative molecular orbital energy diagram.	(10)	K5	CO4

SECTION - E

Answer any ONE of the following

(1 x 20 = 20)

15.	(a)	Mention the rules for arranging the electrons in an orbital.	(5)	K6	CO5
	(b)	Discuss in detail the hybridization and geometry of the following molecules. (i) BeX_2 (ii) NH_3	(5)	K6	CO5
	(c)	Write the rules for assigning oxidation number of an element. Write the balanced equation for the following reaction: $K_2Cr_2O_7 + KI + H^+ \rightarrow K^+ + Cr^{3+} + I_2 + H_2O$	(10)	K6	CO5
16.	(a)	Explain the salient features of band theory. How is it useful in explaining the metallic properties?	(8)	K6	CO5
	(b)	Write the MO electronic configuration and bond order for N_2 , N_2^+ , N_2^- and N_2^{2-} molecules. Arrange the species in the increasing order of their stability.	(7)	K6	CO5
	(c)	Discuss the principle of iodometry and iodimetry titrations.	(5)	K6	CO5

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