

3 (Sem-1/CBCS) CHE HC 1

2021

(Held in 2022)

CHEMISTRY

(Honours)

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 the following questions : 1×7=7

- (a) What is eigenvalue ?
- (b) What is normalisation constant ?
- (c) How many unpaired electrons are there in the element present in fourth period and sixth group of the periodic table ?

(d) What is the IUPAC name of the element having atomic no. 114 ?

(e) How many unpaired electrons are there in O_2^- ion ?

(f) What type of hybridisation does the central atom of BeH_2 molecule undergo ?

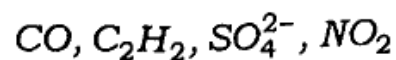
(g) What is the covalency of chlorine in Cl_2O_7 molecule ?

2. Answer the following questions : 2×4=8

- (a) Find the expression of Bohr's radius for the electron of hydrogen atom.
- (b) Calculate the effective nuclear charge experienced by the 4s electron of copper atom.

(c) Calculate the limiting radius ratio, r_+/r_- for Ax_3 type ionic crystal.

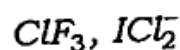
(d) Draw the Lewis electron dot structure of the following :



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

(a) Write a note on Bent's rule.

(b) Using VSEPR theory explain the shapes of the following molecules : $2\frac{1}{2}+2\frac{1}{2}=5$



(c) Give the basic outlines of molecular orbital theory of covalent bonding. 5

(d) Taking the example of lithium explain the band theory of metallic bonding.

5

(e) Write a note on semiconductors. 5

4. Answer the following questions : $10 \times 3 = 30$

(a) Answer **either** (i) and (ii) **or** (iii) and (iv)

(i) What are spherical harmonics ?
Find the expression for normalised angular wave function of p_z orbital.

1+5=6

(ii) State Pauli's antisymmetry principle. Prove that two electrons with same set of four quantum numbers cannot stay together.

1+3=4

Or

(iii) Write a note on radial probability distribution function. 6

(iv) Explain aufbau principle. 4

(b) Answer **either** (i) and (ii) **or** (iii) and (iv)

(i) Discuss the variation in ionisation energies of the elements present in second period of the periodic table. 5

(ii) Discuss Mulliken's scale of electronegativity. 5

Or

(iii) What is electron gain enthalpy? What are the factors on which it depends? Discuss its variation in a group and along a period.

1+2+3=6

(iv) Electronegativity values of H, F and Cl are 2.1, 4.0 and 3.5 respectively. Calculate percent ionic character in HCl and HF bond. 2+2=4

(c) Answer **either** (i) and (ii) **or** (iii) and (iv)

(i) How can you determine lattice energy of NaCl using Born-Haber cycle. Explain. 6

(ii) What is standard electrode potential? How can it be applied to predict the feasibility of a reaction? 1+3=4

Or

(iii) Draw the molecular orbital energy level diagram of CO molecule. Write its electronic configuration. Find its bond order and give its magnetic behaviour. 3+1+(1+1)=6

(iv) What is redox reaction ? Write the reactions involved in the estimation of Fe^{2+} ion using standardized $KMnO_4$ solution.

1+3=4

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