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 change 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 :

$CO, C_2H_2, SO_4^{2-}, NO_2$

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 : 2½+2½=5

ClF_3, ICl_2^-

(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 : 10×3=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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