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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 : $1 \times 7 = 7$

- (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 ?

Contd.

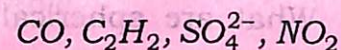
- (d) What is the IUPAC name of the element having atomic no. 114 ?
- (e) How many unpaired electrons are there in O_2^- ion ?
- (f) What type of hybridisation does the central atom of BeH_2 molecule undergo ?
- (g) What is the covalency of chlorine in Cl_2O_7 molecule ?

2. Answer the following questions : $2 \times 4 = 8$

- (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 : $5 \times 3 = 15$

- (a) Write a note on Bent's rule.
- (b) Using VSEPR theory explain the shapes of the following molecules : $2\frac{1}{2} + 2\frac{1}{2} = 5$
 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 : $10 \times 3 = 30$

(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