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5231

M.Sc. (Sem. I) Examination, Jan. 2019

CHEMISTRY

Paper 1.1

CHEM-511

Inorganic Chemistry

Time Allowed : Three Hours

Max. Marks : 70

Min. Pass Marks : 28

This question paper contains three sections as under

Section-A ***Max. Marks-10***

*will carry **10** marks with **1** compulsory question comprising **10** short answer type questions (minimum **20** words answer) taking two questions from each unit Each question shall be of one mark.*

Section-B ***Max. Marks-25***

*will carry **25** marks with equally divided into five long answer type questions (answer about in **250** words). Students are instructed to attempt **five** questions by selecting **one** question from each unit.*

Section-C ***Max. Marks-35***

*will carry **35** marks with five long answer type questions comprising one compulsory question (question No. **7**) of **15** marks and four questions of **10** marks each. Students are instructed to attempt total **three** questions with **one** compulsory question (answer about in **500** words) and any **two** more questions (answer about in **400** words) out of remaining four questions.*

Section A

1. Explain, why ? $10\times1=10$

(*i*) The bond angle in $N(CF_3)_3$ is 118.2°, whereas the same angle in $N(OH)_3$ is 102°.

(*ii*) NH_4^+ ion is more stable than PH_4^+ ion.

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(iii) NH_3 is strong field ligand than H_2O

(iv) $[Cu(en)_3]^{2+}$ is very less stable than $[Cu(en)_2(H_2O)_2]^{2+}$.

(v) The values of $\Delta_{hyd}G^\circ$ for Cr^{3+} and Fe^{3+} are almost equal, yet $[Cr(H_2O)_6]^{+3}$ undergoes substitution slowly and $[Fe(H_2O)_6]^{3+}$ rapidly or kinetically labile.

(vi) $[Cs(H_2O)_8]^+$ is kinetically labile.

(vii) BF_3 possesses an S_3 axis, but NF_3 does not.

(viii) $[AuCl_4]^-$ has a centre of symmetry, but $[CoCl_4]^{2-}$ does not.

(ix) The vibrational modes of OF_2 molecule at 928, 831 and 461 cm^{-1} are all IR active.

(x) The S_8 ring does not contain a C_8 axis.

Section B

UNIT-I

2. Explain the structure of the following molecules/ ions with the help of Gillespie-Nyholm theory : 5×1=5

(i) $[XeF_5]^-$

(ii) $[SbCl_6]^{3-}$

(iii) NSF_3

(iv) XeF_6

(v) $[XeF_8]^{2-}$.

Or

Discuss the molecular shape with bond angles and bond lengths of the following molecules :

(i) PCl_2F_3 1.5

(ii) CH_3F 1

(iii) $S_4N_4F_4$. 2.5

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UNIT-II

3. Describe bonding in $[PtCl_4]^{2-}$ complex ion with the help of molecular orbital theory 5

Or

Discuss the effect of back bonding in metal complexes with suitable examples

UNIT-III

4. Explain and draw sketches/graphs to predict variation across the first row transition metal series of ionic radius of M^{2+} in the oxide; MO and in the cyanides; $M(CN)_2$ 5

Or

Discuss the role of ligand field activation energy to predict labileness and inertness of the metal complexes.

UNIT-IV

5. Draw a scheme/diagram for assigning point groups of the molecules and molecular ions using the Schoenflies notation. 5

Or

Discuss importance of matrix to represent a group of bent molecules

UNIT-V

6. Construct a character table for point group belongs to the SF_4 molecule. 5

Or

Construct a set of hybrid orbitals with tetrahedral geometry by the irreducible and reducible representations.

Section C

7. Explain the bonding and magnetic properties of ferrocene with the help of molecular orbital theory. 15

8. (*i*) Explain why NH_3 is pyramidal whereas BH_3 is planar by using energy correlation diagram.

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(ii) Discuss d_{xy} bonding with suitable examples. 6+4=10

9. Write short notes on 5+5=10

(i) Chelate effect

(ii) Limitations of CFT

10. Discuss the great orthogonality theorem with suitable examples. 10

11. Explain relationship between reducible and irreducible representations and find out the number of IR active bands in H_2O moleculer. 5+5=10

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