

PG Odd Semester (CBCS) Exam., December—2016

CHEMISTRY

(1st Semester)

Course No. : CH-101 (C)

(Inorganic Chemistry—I)

Full Marks : 75

Pass Marks : 30

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. (a) Work out the symmetry point group symbol of the following : $1\frac{1}{2} \times 4 = 6$
- (i) H_2S
- (ii) O_2^2
- (iii) PF_5
- (iv) H_3O
- (b) For a C_{2v} point group, using matrix representation of symmetry elements, find C_2^2 . 5

- (c) Based on symmetry criteria, assess if BF_3 is polar or not. 4
2. (a) Determine the symmetry point group of the following : $2 \times 3 = 6$
- (i) CO_3^2
- (ii) C_2HCl
- (iii) POBr_3
- (b) Show how the symmetry element i can be represented by matrix notation. 4
- (c) Work out the point group of staggered $\text{Fe}(\text{C}_5\text{H}_5)_2$. Comment on its polarity. 5

UNIT—II

3. (a) Draw the VSEPR compliant structures of the following. Comment on the nature of distortions : $2 \times 3 = 6$
- (i) XeF_2
- (ii) PF_3Cl_2
- (iii) ClF_3
- (b) Draw the MO diagram of CO and rationalize its coordination to metal via carbon. 5
- (c) Discuss the Allred-Rochow scale of electronegativity. 4

(3)

4. (a) Account for the variation in bond angle
 $\text{NH}_3(107^\circ 3')$, $\text{PH}_3(93^\circ 3')$, $\text{AsH}_3(91^\circ 8')$. 5
- (b) Explain the nature of H-bond in
crystalline HF. 3
- (c) "The NSi_3 skeleton in $(\text{R}_3\text{Si})_3\text{N}$ is
planar." Rationalize. 4
- (d) Define 'chemical hardness'. 3

UNIT—III

5. (a) Draw and comment on the structure of
the following : 4
- (i) $[\text{Fe}(\text{CO})_3\text{B}_4\text{H}_8]$
- (ii) *Closo*-1,12- $\text{B}_{10}\text{C}_2\text{H}_{12}$
- (b) Define 'polyoxometalates'. Discuss the
synthesis strategy of $[\text{Mo}_6\text{O}_{19}]^{2-}$ and
 $[\text{Mo}_8\text{O}_{26}]^{4-}$. 4
- (c) "Non-stoichiometric oxides can be
regarded as solid solution." Elucidate. 3
- (d) Write a note on polymorphism of
carbon. 4

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(Turn Over)

(4)

6. (a) Draw the structure of B_5H_9 and furnish
its styx number. 4
- (b) Apply Wade's rule to predict the
structure of $\text{B}_{10}\text{H}_{14}$. 4
- (c) Give the synthesis and structure of P_4 . 3
- (d) Draw the structures of the following : 4
- (i) $[(\text{CH}_3)_2\text{PN}]_3$
- (ii) $[\text{Cl}_2\text{PN}]_4$

UNIT—IV

7. (a) Write short notes on the following : $3 \times 2 = 6$
- (i) Carbon credit
- (ii) CO_2 sequestration
- (b) Discuss the relevant chemical reactions
in relation to arsenic pollution in
groundwater. 5
- (c) Write a note on the significance of ionic
gradient across the cell membrane. 4
8. (a) Write notes on the following : $3 \times 2 = 6$
- (i) Cd toxicity
- (ii) Ionophores

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(Continued)

(5)

- (b) Mention the essential trace-elements in biological system. Point out the role of any two elements. 5
- (c) Sketch the structure of 18-crown-6 and 2.2.1. cryptand. Comment on the selectivity in ion-binding. 4

UNIT—V

9. (a) Write notes on the following : 6
(i) Spectator ligand
(ii) Interchange reaction mechanism
- (b) Propose efficient routes to the synthesis of *cis*- and *trans*-[PtCl₂(NH₃)(PPh₃)] from the reactants PPh₃, NH₃ and [PtCl₄]²⁻. Give suitable explanation. 5
- (c) Explain 'Bailar twist' mechanism of racemization in tris-chelates. 4
10. (a) The acid hydrolysis of the complex [Co(NH₃)₄(CO₃)] is many times faster than in neutral solution. Explain. 3
- (b) Write the relevant chemical reactions for base hydrolysis of [CoCl(NH₃)₅]²⁺. What prompts acceleration of the reaction? 6

(6)

- (c) What is meant by 'stereochemical non-rigidity'? The ¹⁹F NMR spectrum of a *tbp*-PF₅ shows only a single line at room temperature. Rationalize. 6
