

(i) Printed Pages : 7 Roll No. ....

(ii) Questions : 7 Sub. Code : 

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Exam. Code : 

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Bachelor of Science (FYUP) 4<sup>th</sup> Semester

(2056)

## CHEMISTRY

Paper : General Chemistry-5 (Inorganic Chemistry)

Time Allowed : 3 Hours]

[Maximum Marks : 67

Note :- Attempt **FOUR** questions in all selecting **ONE** question from each Unit. Q. No. 1 of Unit I is compulsory

### UNIT—I

1. (a) Multiple Choice Questions:

(i) Which of the following interhalogen is not known?

(a)  $\text{IF}_7$

(b)  $\text{FCl}_3$

(c)  $\text{ClF}_3$

(d)  $\text{BrF}_3$

(ii) The Oxidation state of Nitrogen in  $\text{N}_2\text{H}_4$  is:

(a) +4

(b) +2

(c) -2

(d) -4

- (iii) What is the shape of  $I_3^-$  ion?
- (a) Linear (b) Triangular Planer  
(c) Bent shape (d) Pyramidal
- (iv) A crystal having lattice parameter  $a = b = c$ ,  $\alpha = \beta = \gamma = 90^\circ$  belongs to the crystal system:
- (a) Monoclinic (b) Cubic  
(c) Triclinic (d) Orthorhombic
- (v) Number of NaCl units present in one unit cell of NaCl.
- (a) 1 (b) 2  
(c) 3 (d) 4
- (vi) If in a crystal the intercepts are 1,  $\infty$ ,  $\infty$  the Miller Indices are:
- (a) 100 (b) 101  
(c) 110 (d) (000)
- (vii) Which of the following is most acidic in nature?
- (a) m-nitrophenol (b) p-methylphenol  
(c) phenol (d) p-nitrophenol
- (viii) Electrophile in Riemer-Tiemann reaction is:
- (a)  $CHCl_3$  (b)  $CHO^+$   
(c)  $:CCl_2$  (d)  $^-CCl_3$

- (ix) Detection and Estimation of alkoxy groups can be done by:
- Ziesel Method
  - Hoffmann method
  - Lucas test
  - Liebermann nitroso test
- (b) (i) Write down the formula of Caro's acid.
- (ii) What is the formula of Oxide of Nitrogen which is called as blue solid?
- (iii) Why fluorine is more reactive than other Halogens?
- (iv) Give structure of  $S_4N_4$ .
- (v) Define Space Lattice.
- (vi) How many Elements of axis of symmetry exist in cubic crystal system?
- (vii) What is the role of doping in solid-solid reactors?
- (viii) Why ethers act as Lewis bases?
- (ix) Phenols turn blue litmus red while  $C_2H_5OH$  fails to do so. Explain.
- (x) Why alcohols have higher boiling point than ethers of comparable masses?  $19 \times 1 = 19$

## UNIT—II

2. (a) How is  $\text{H}_3\text{PO}_4$  prepared? Draw its structure. What is its basicity? What is the reaction of water with  $\text{P}_4\text{O}_6$  and  $\text{P}_4\text{O}_{10}$ ?
- (b) Discuss the shape and geometry of  $\text{ClF}_3$  and  $\text{IF}_5$ .
- (c) Explain the thermal stability and acidic character of various halogen acids.
- (d) Explain why:
- (i)  $\text{SF}_6$  has zero dipole moment while  $\text{SF}_4$  has non-zero dipole moment.
  - (ii) Bond angle in  $\text{OF}_2$  is smaller than  $\text{Cl}_2\text{O}$ . 4×4=16
3. (a) (i) Explain why  $\text{ICl}_7$  does not exist while  $\text{IF}_7$  exists.
- (ii) What are Pseudo halogens? Give Example.
- (iii) Draw the structure of  $\text{P}_4\text{O}_6$ ,  $\text{P}_4\text{O}_{10}$ .
- (b) Explain the acidic behaviour and reducing character of hydrides of group 16 elements.
- (c) Discuss the acidic order of various oxoacids of chloride.
- (d) Write names and chemical formulae of all oxyacids of phosphorus along with their basicity. 4×4=16

## UNIT—III

4. (a) Describe about Williamson synthesis of ethers. What are its limitations?

- (b) Discuss the acidic strength of  $1^\circ$ ,  $2^\circ$ ,  $3^\circ$  alcohols. How Lucas test can be used to differentiate these three types of alcohols? Give chemical reactions.
- (c) What is cumin? How can it be obtained? How can it be converted into phenol? Give mechanism.
- (d) Write down the mechanism of following reactions:
- (i) Reimer-Tiemann Reaction
  - (ii) Kolbe's Reaction 4×4=16
5. (a) Give the structure and names of the main product formed by the following reagents with Phenol.
- (i)  $\text{CO}_2$ , high pressure
  - (ii) Aq. Bromine
  - (iii)  $\text{CHCl}_3$ , Aq. NaOH, 343 k
  - (iv) Acetic anhydride
- (b) Write the mechanism of dehydration of alcohol with Conc.  $\text{H}_2\text{SO}_4$ . Account for the fact that dehydration of n-butyl alcohol yields mainly 2-butene rather than 1-butene.
- (c) Explain the following with mechanism.
- (i) Fries rearrangement
  - (ii) Gatterman synthesis

- (d) Give the mechanism of ring opening reactions of epoxides in the presence of an acid and a base. What is the orientation of ring opening reaction?  $4 \times 4 = 16$

#### UNIT—IV

6. (a) Derive Bragg's Equation.
- (b) What are the advantages of powder method over Bragg's single crystal method? Using this method, how interplanar spacing can be calculated?
- (c) What type of lattices are exhibited by NaCl, KCl, and CsCl? Represent them diagrammatically. Why diffraction pattern of NaCl and KCl are different?
- (d) (i) What do you understand by Miller Indices? Calculate the Miller Indices of crystal planes which cut through the crystal axis at  $(6a, 3b, 3c)$ .
- (ii) What do you understand by 3-fold axis of symmetry?  $4 \times 4 = 16$
7. (a) What are the elements of symmetry in crystallography? Describe each of them briefly.
- (b) (i) What are the main points of difference between crystalline solids and amorphous solids?
- (ii) Derive an expression for the distance of separation of  $(hkl)$  planes of an orthogonal system.

- (c) The (111) plane of a cubic crystal shows a glancing reflection at  $\theta = 14^\circ 18'$  with x-rays of  $\lambda = 154.2$  pm. Calculate the interplanar spacing and length of the unit cell. ( $\sin 14^\circ 18' = 0.2450$ )
- (d) Describe the basic principle of Laue's diffraction method for the study of crystal system. What are its limitations?

4×4=16