

2022

## CHEMISTRY — HONOURS

Paper : CC-6

(Inorganic Chemistry)

Full Marks : 50

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.**Question no. 1 is compulsory and answer any eight questions from the rest.*1. Answer *any ten* questions :

1×10

- Which has the higher second ionisation energy : Cu or K?
- Give an example of ambidentate ligand with proper complexes.
- Give one use each of Xe and Ar.
- Write the structure of bis(en)Co(III)- $\mu$ -imido- $\mu$ -hydroxido-bis(en) Co(III) ion.  
[en = ethylenediamine]
- Write the manganese species generated in the reaction when aq. solution of Mn(II) is boiled with potassium perdisulfate in presence of little AgNO<sub>3</sub>. Mention the role of AgNO<sub>3</sub>.
- Predict the products of the following reaction :  
 $\text{CF}_3\text{I} + \text{OH}^- \rightarrow \text{A} + \text{B}$
- Mention an example each of an interstitial and covalent hydride.
- Draw the structure of SO<sub>3</sub><sup>2-</sup> ion. Mention its shape.
- Write any one chemical property of Be and Al to show the diagonal relationship amongst them.
- What are organo-silicon compounds called? Give one example.
- What happens when S<sub>2</sub>N<sub>2</sub> is kept at 0°C for long time?
- Which effect is mainly responsible for very high electron affinity of Au?

- Catenation tendency among the following Gr-16 elements follow the trend : O < S > Se – explain.
- Difference in IE<sub>1</sub> between C and Si is greater than that between Si and Ge. State reasons.

3+2

Please Turn Over

X(3rd Sm.)-Chemistry-H/CC-6/CBCS

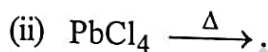
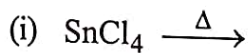
(2)

3. (a) Draw the structures of the isomers of  $[\text{Co}(\text{en})(\text{NH}_3)_2\text{Cl}_2]^+$  and indicate the types of isomerism.  
(b) Explain the following order of ionization energies ( $\text{IE}_1$  in kJ/mole):  
 $_{29}\text{Cu}$  (745),  $_{30}\text{Zn}$  (906),  $_{31}\text{Ga}$  (579) 3+2
4. (a) Calculate the effective nuclear charge of 3d and 4s electrons of Co ( $Z = 27$ ) using Slater's rule and identify which type of electron will be lost when Co forms a positive ion.  
(b) Solubilities of alkali metal hydroxides in water follow the order:  
 $\text{LiOH} < \text{NaOH} < \text{KOH} < \text{RbOH} < \text{CsOH}$  – Justify. 3+2
5. (a) Calculate the Allred-Rochow electronegativity of Zn having its covalent radius 125 pm.  
(b) No simple salts of  $\text{B}^{3+}$  are known but those of  $\text{Al}^{3+}$  are numerous – Justify. 3+2
6. (a) Give the examples of Fluoridating, Fluorinating and Oxidising properties of  $\text{XeF}_4$ .  
(b) Give the structure of basic beryllium nitrate. 3+2
7. (a) Show by chemical reactions the method for the synthesis of Borazines. What happens when borazine is subjected to prolonged heating at  $380^\circ\text{C}$ ?  
(b) Explain the enhanced stability of  $[\text{Ni}(\text{en})_3]^{2+}$  over  $[\text{Ni}(\text{NH}_3)_6]^{2+}$  from thermodynamic point of view. 3+2
8. (a) Compare and discuss the allotropic modifications of N and P.  
(b) Lanthanides are placed in just one group in the Periodic Table but transition series elements are not – explain. 3+2
9. (a) Explain the bonding in  $\text{XeF}_2$  through molecular orbital treatment.  
(b)  $\text{H}_2\text{S}_2\text{O}_7$  is stronger acid than  $\text{H}_2\text{SO}_4$  – Justify. 3+2
10. (a) Explain the observations with equations:  
(i) When iodine-azide solution is mixed with little  $\text{Na}_2\text{S}$ , its brown colour fades away with evolution of bubbles.  
(ii) Aqueous sodium thiosulfate gets turbid when allowed to stand for long time.  
(b)  $\text{NO}_2$  is readily dimerized whereas  $\text{NO}$  does not – Explain. 3+2
11. (a) Complete the following reactions:  
(i)  $\text{ClF} + \text{BF}_3 \rightarrow$   
(ii)  $(\text{NPCl}_2)_3 + \text{CH}_3\text{MgI} \rightarrow$   
(iii)  $2\text{XeO}_2\text{F}_2 + \text{SiO}_2 \rightarrow$   
(b) Place the following species in appropriate classes:  
 $\text{BrF}_5$ ,  $\text{CN}^-$ ,  $\text{I}_3^-$ ,  $\text{Br}_3^+$ . 3+2

(3)

X(3rd Sm.)-Chemistry-H/CC-6/CBCS

12. (a) Draw the actual structures of  $\text{XeO}_2\text{F}_2$  and  $\text{XeO}_6^{4-}$ . Hence predict the actual shapes.  
(b) Conductivity of  $\text{BrF}_3(\text{l})$  increases on addition of  $\text{KF}$  – Justify. 3+2
13. (a) Draw the structures of  $\text{P}_4\text{O}_6$  and  $\text{P}_4\text{O}_{10}$ . Compare P–O bond lengths in P–O–P bridges in these two compounds.  
(b) Predict the feasibility of the following reactions :



3+2

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