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

(a) Which has the higher second ionisation energy : Cu or K?

(b) Give an example of ambidentate ligand with proper complexes.

(c) Give one use each of Xe and Ar.

(d) Write the structure of bis(en)Co(III)-μ-imido-μ-hydroxido–bis(en) Co(III) ion.
[en = ethylenediamine]

(e) Write the manganese species generated in the reaction when aq. solution of Mn(II) is boiled with potassium perdisulfate in presence of little $AgNO_3$. Mention the role of $AgNO_3$.

(f) Predict the products of the following reaction :

$CF_3I + OH^- \rightarrow A + B$

(g) Mention an example each of an interstitial and covalent hydride.

(h) Draw the structure of SO_3^{2-} ion. Mention its shape.

(i) Write any one chemical property of Be and Al to show the diagonal relationship amongst them.

(j) What are organo-silicon compounds called? Give one example.

(k) What happens when S_2N_2 is kept of 0°C for long time?

(l) Which effect is mainly responsible for very high electron affinity of Au?

2. (a) Catenation tendency among the following Gr–16 elements follow the trend : O < S > Se – explain.

(b) Difference in IE_1 between C and Si is greater than that between Si and Ge. State reasons. 3+2

3. (a) Draw the structures of the isomers of $[Co(en)(NH_3)_2Cl_2]^+$ and indicate the types of isomerism.
   (b) Explain the following order of ionization energies (IE_1 in kJ/mole) :
   $_{29}Cu$ (745), $_{30}Zn$ (906), $_{31}Ga$ (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 :
   LiOH < NaOH < KOH < RbOH < CsOH – Justify. 3+2

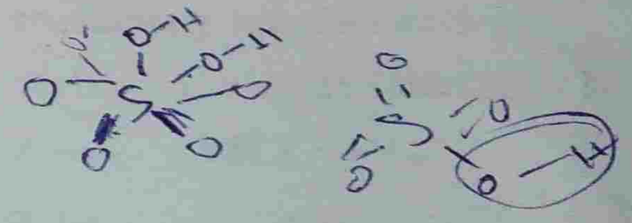
5. (a) Calculate the Allred-Rochow electronegativity of Zn having its covalent radius 125 pm.
   (b) No simple salts of B^{3+} are known but those of Al^{3+} are numerous – Justify. 3+2

6. (a) Give the examples of Fluoridating, Fluorinating and Oxidising properties of 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°C?
   (b) Explain the enhanced stability of $[Ni(en)_3]^{2+}$ over $[Ni(NH_3)_6]^{2+}$ 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 XeF_2 through molecular orbital treatment.
   (b) $H_2S_2O_7$ is stronger acid than H_2SO_4 – Justify. 3+2



10. (a) Explain the observations with equations :
   (i) When iodine-azide solution is mixed with little Na_2S, its brown colour fades away with evolution of bubbles.
   (ii) Aqueous sodium thiosulfate gets turbid when allowed to stand for long time.
   (b) NO_2 is readily dimerized whereas NO does not – Explain. 3+2

11. (a) Complete the following reactions :
   (i) $ClF + BF_3 \rightarrow$
   (ii) $(NPCl_2)_3 + CH_3MgI \rightarrow$
   (iii) $2XeO_2F_2 + SiO_2 \rightarrow$
   (b) Place the following species in appropriate classes :
   BrF_5, CN^-, I_9^-, Br_3^+. 3+2

12. (a) Draw the actual structures of XeO_2F_2 and XeO_6^{4-}. Hence predict the actual shapes.

(b) Conductivity of $BrF_3(l)$ increases on addition of KF – Justify. 3+2

13. (a) Draw the structures of P_4O_6 and P_4O_{10}. Compare P–O bond lengths in P–O–P bridges in these two compounds.

(b) Predict the feasibility of the following reactions :

(i) $SnCl_4 \xrightarrow{\Delta}$

(ii) $PbCl_4 \xrightarrow{\Delta}$. 3+2
