

2023

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) Arrange the following in order of their increasing size :
 H^- , F^- , Cl^- and Br^- .
 - (b) Between white phosphorus and red phosphorus, which one is less reactive?
 - (c) Draw the VSEPR structure of PH_4^+ .
 - (d) Give an example of clathrate compound.
 - (e) Cite an example of coordination isomer.
 - (f) Give the products of the reaction : $\text{BF}_3 + \text{EtOH} \rightarrow ?$
 - (g) In which estimation $\text{S}_2\text{O}_8^{2-}$ is used as an oxidizing agent?
 - (h) Write the formula of pentaammine(dinitrogen)ruthenium(III)chloride.
 - (i) Write one example of innermetallic complex.
 - (j) Find the most stable dihalide : SnCl_2 , GeCl_2 , PbCl_2 .
 - (k) Give an example of paramagnetic nitrogen oxide.
 - (l) What is Wj's solution?
2. (a) How does the structure of graphite account for its use as (i) lubricant (ii) electrodes?
(b) Write down a chemical reaction to establish the basic properties of halogens. 3+2
3. (a) Calculate the electronegativity of chlorine in the Mulliken's scale. Hence, find out the electronegativity in the Pauling's scale. EA of Cl = 4.0 eV/atom, I.E. of Cl = 13 eV/atom.
(b) Show that BH_3 can behave as both electron acceptor and donor in the adduct OC.BH_3 . 3+2
4. (a) Explain the greater oxidizing power of selenate and tellurate than that of sulfate.
(b) Aqueous solution of Be^{2+} salt is acidic in nature. Explain. 3+2

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5. (a) Justify the ionization energy values of the following elements :

Element	I_1 (eV)	I_2 (eV)
Ga	5.99	20.51
Ge	7.89	15.93
As	9.81	18.63

- (b) A mixture of FeSO_4 and $(\text{NH}_4)_2\text{SO}_4$ (1:1 mole ratio) in aqueous solution gives the test for Fe^{2+} while a mixture of CuSO_4 and NH_4OH (excess) does not give the test for Cu^{2+} . Justify. 3+2
6. (a) 'C' shows highest catenation property among C, Si and Ge.— Justify with suitable compounds.
 (b) How trace amount of Al^{3+} can be detected using chelating ligand? Provide the structure and colour of the chelate. 3+2
7. (a) Complete the following reactions :
 (i) $\text{NaNH}_2 + \text{N}_2\text{O} \longrightarrow$
 (ii) $\text{KBrF}_4 \xrightarrow{\Delta}$
 (iii) $\text{XeF}_6 + \text{H}_2\text{O} \longrightarrow$
 (b) What happens when NO_2 gas is cooled? Mention the visual change, if any. 3+2
8. (a) What are phosphazenes? P-N bond distances in $\text{P}_3\text{N}_3\text{F}_6$ are shorter than those in $\text{P}_3\text{N}_3\text{Cl}_6$. — Explain.
 (b) $\text{F}-\widehat{\text{Xe}}-\text{O}$ angle in XeOF_4 is nearly 90° . — Justify. 3+2
9. (a) Using VSEPR theory, justify the expected trend of $\text{O}-\widehat{\text{N}}-\text{O}$ bond angles in NO_2^+ , NO_2 and NO_2^- .
 (b) What abnormal properties of liquid Helium are observed when it is cooled below 2K? 3+2
10. (a) Compare the basicities of tri-metaphosphoric acid and tri-polyphosphoric acid from their structures.
 (b) Write down the structure of an optically active purely inorganic complex. 3+2
11. (a) Write down the postulates of Werner's theory with suitable examples.
 (b) There are no stable sulfur analogues of CO and NO. — Explain. 3+2
12. (a) Reducing property of hydrides increases in going from top to bottom in any group. Justify your answer with suitable reactions.
 (b) Atomic size of niobium ($Z = 41$) and tantalum ($Z = 73$) are almost identical. — Justify. 3+2
13. (a) Compare the hydrolysis products of Me_3SiCl and Me_3CCl with proper reason.
 (b) Mercury is liquid at room temperature. Explain. 3+2