2025

CHEMISTRY — HONOURS

Paper : DSCC-10

(Inorganic Chemistry - III)

Full Marks : 75

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer ***question nos.*** **1, 2, 3, 4** (compulsory) and ***any four*** questions from the rest (***question nos.*** **5 – 10**).

1. Answer ***any ten*** questions : 2×10

   (a) Write one general property of s-block and p-block elements each.

   (b) In between NF_3 and NCl_3 which compound undergoes hydrolysis? Mention the reason behind the inertness of the species not undergoing hydrolysis.

   (c) Write down the structures of tri-metaphosphoric acid and tri-polyphosphoric acid.

   (d) Name two peroxo acids of sulphur with molecular formulae.

   (e) Which halogen mainly shows basic property? Mention the reason behind its basic property.

   (f) Give one use each of He and Xe.

   (g) What are silicones? State one of its use.

   (h) Write down two general characteristics of inorganic polymers.

   (i) What are the highest oxidation states of 3d and 5d elements? Mention the names of the elements.

   (j) Write the electronic configurations of Ce (Z = 58) and Lu (Z = 71).

   (k) Write down the examples of two magic number nuclides.

   (l) Indicate two isotopes used in nuclear medicine for diagnostic and therapeutic purposes.

2. Write short notes on :

   (a) 'Diborane' based on the following points :

   (i) Preparation

   (ii) Structure

   (iii) Bonding. 1+1+3

Or

(b) 'P_4O_{10}', based on the following points :

(i) Preparation

(ii) Structure

(iii) Stepwise hydrolysis. 1+1+3

3. Write short notes on :

(a) 'Interhalogen compounds', based on the following points :

(i) Definition with examples

(ii) General properties. 2+3

Or

(b) $(NPCl_2)_3$ based on the following points :

(i) Preparation

(ii) Structure

(iii) Comparison of P–N bond distance with $(NPF_2)_3$. 1½+1½+2

4. Write short notes on :

(a) 'Lanthanide contraction' based on the following points :

(i) Definition

(ii) Reason

(iii) Consequences. 1+1+3

Or

(b) 'Liquid drop model' based on the following points :

(i) Similarity between a liquid drop and a nucleus (three points)

(ii) Comparison with shell model. 3+2

5. (a) Write down one preparative method, structure and IUPAC name of basic beryllium acetate.

(b) Give a brief outline of the ion-exchange method of separation of the lanthanide elements.

(c) What are the similarities and differences in the structures of $(BN)_x$ and graphite? (1+2+1)+3+3

6. (a) Compare the acidic property and oxidising property of oxyacids of chlorine.

(b) Discuss the principle of 'Isotope dilution method'.

(c) What are pseudohalides? Give two chemical reactions to establish their similarities with halides. (2+2)+3+3

7. (a) Write down the reactions and visual observations when
   (i) Borax is strongly heated
   (ii) Borax is heated with CH_3OH and concentrated H_2SO_4.
   (b) Compare the spectral properties of lanthanoids and actinoids by outlining three points of difference.
   (c) What are clathrates? Give one example and one use with reference to noble gas elements. (2+2)+3+3

8. (a) Write down the structure and bonding of S_4N_4.
   (b) "NO_2 undergoes dimerization but ClO_2 not."— Explain.
   (c) "The dilute solution of Na in pure liquid NH_3 is blue and paramagnetic."— Explain. 4+3+3

9. (a) (i) Compare metal-metal bond forming tendency of 3d, 4d and 5d elements.
   (ii) "Lanthanides exhibit +3 oxidation state in general."— Explain.
   (b) What are fluorocarbons? Why are they inert?
   (c) "A radioisotope can be used in the evaluation of reaction mechanism."— Discuss. (2+2)+3+3

10. (a) What is 'Radiometric titration'? How trace amount of Zn^{2+} can be determined with Na_2H_2 EDTA radiometrically?
   (b) "Gallium dichloride is diamagnetic."— Explain.
   (c) Write down one preparative method with equation for XeO_3 and XeO_6^{4-}. 4+3+3
