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3 SEM TDC CHMH (CBCS) C 5

2022

(Nov/Dec)

CHEMISTRY

(Core)

Paper : C–5

(Inorganic Chemistry)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct answer from the following : 1×5=5

(a) Which of the following acids results from better hard-hard combination?

(i) HCN

(ii) HI

(iii) HCl

(iv) HNO_2

(b) Which one of the following is the correct order of increasing basicity?

(i) $CH_3NH_2 < (CH_3)_2NH < (CH_3)_3N < (CH_2CH_3)_3N$

(ii) $CH_3NH_2 < (CH_3)_2NH < (CH_2CH_3)_3N < (CH_3)_3N$

(iii) $CH_3NH_2 < (CH_2CH_3)_3N < (CH_3)_2NH < (CH_3)_3N$

(iv) $(CH_2CH_3)_3N < CH_3NH_2 < (CH_3)_2NH < (CH_3)_3N$

(c) The type of hybridization for IF_5 is

(i) sp^3d

(ii) sp^3d^3

(iii) sp^3d^2

(iv) d^2sp^3

(d) The shape of $XeOF_4$ molecule with sp^3d^2 hybridization is

(i) pentagonal bipyramidal

(ii) octahedral

(iii) trigonal bipyramidal

(iv) square pyramidal

(e) In clathrates, the host-guest interaction is also known as

(i) covalent interaction

(ii) ionic interaction

(iii) coordination interaction

(iv) non-covalent interaction

2. Answer any *six* questions of the following : 2×6=12

(a) What are interhalogen compounds? Give examples.

(b) Compare the acid strength of $[Fe(H_2O)_6]^{3+}$ and $[Fe(H_2O)_6]^{2+}$.

(c) Give two reactions to show resemblance of lithium with magnesium.

(d) Draw the structure of boric acid.

(e) Write a short note on hydrometallurgy.

(f) Why helium and neon do not form clathrates?

(g) XeF_6 cannot be stored in glass vessel. Explain with chemical reaction.

(h) Discuss the effect of dielectric constant of solvents in relative strength of acids and bases.

3. Answer any *four* questions of the following : 3×4=12

(a) What are *closo-*, *nido-* and *arachno-* boranes? Give one example of each.

(b) What are polyhalides? Among the halogens, iodine has the maximum tendency to form polyhalide anion. Explain the statement.

(c) What are silicones? Give the preparation of cross-linked silicones.

(d) Why is borazine called inorganic benzene? How is it prepared from diborane? Give a reaction to distinguish borazine from benzene.

(e) What are hydrides? Classify different types of hydrides with one example of each.

(f) Discuss the formation of 3*c*—2*e* bonds in diborane from molecular orbital theory. (Give the required MO diagrams)

4. Answer any *three* questions of the following : 4×3=12

(a) Mention the Wade's rules for determining the skeletal structure of boranes. Applying these rules, predict the structure of B_5H_{11} and $C_2B_4H_8$. 2+2=4

(b) Define acids and bases from solvent system theory. Discuss the acid-base behaviour of NH_4Cl and KNH_2 in liquid ammonia. 2+2=4

(c) Complete the following reactions : 1×4=4

(i) $H_3BO_3 + NaOH + H_2O \longrightarrow ?$

(ii) $BCl_3 + LiAlH_4 \longrightarrow ?$

(iii) $XeF_6 + SiO_2 \longrightarrow ?$

(iv) $NaNO_3 + H_2SO_4 \xrightarrow{150\,^\circ C - 200\,^\circ C} ?$

(d) What is meant by diagonal relationship of elements in the periodic table? Discuss the diagonal relationship between lithium and magnesium. 1+3=4

5. Answer any *three* questions of the following : 3×3=9

(a) What are phosphazines? Discuss the structure of hexachlorocyclotriphosphazine. 1+2=3

(b) State the HSAB principle. Explain why $[CoF_6]^{3-}$ is more stable than $[CoI_6]^{3-}$. 1+2=3

(c) What are the reasons for the anomalous behaviour of fluorine with its group members? Compare the variation of oxidation states of group 17 elements. 2+1=3

(d) Give the names of oxo-acids of chlorine. Compare the acid strength of oxo-acids of chlorine. 2+1=3

6. Answer *either (a) or (b)* from the following : 3

(a) Give the structures of—

(i) P_2O_5

(ii) $H_2S_2O_8$

(iii) $HClO_4$ 1+1+1=3

(b) Write short notes on any *two* of the following : 1½×2=3

(i) Zone refining

(ii) Fullerenes

(iii) Carbon reduction

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