

2019

CHEMISTRY

(Major)

Paper : 4.2

Full Marks : 60

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Select the correct answer/Answer the following questions : 1×7=7

(a) The shape of the molecule XeO_2F_2 is

- (i) distorted tetrahedral
- (ii) tetrahedral
- (iii) trigonal bipyramidal
- (iv) square planar

(b) Which of the following species does not have a linear shape?

- (i) I_3^+
- (ii) I_3^-
- (iii) ICl_2^-
- (iv) IBrF^-

(2)

(c) The existence of two different coloured complexes of $\text{Co}(\text{NH}_3)_4\text{Cl}_2$ is due to

- (i) optical isomerism
- (ii) geometrical isomerism
- (iii) linkage isomerism
- (iv) coordination isomerism

(d) The transition element having least enthalpy of atomization is

- (i) Fe
- (ii) V
- (iii) Cu
- (iv) Zn

(e) The carborane $\text{B}_{10}\text{C}_2\text{H}_{12}$ is isoelectronic with which one of the following?

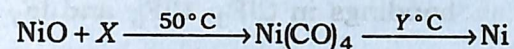
- (i) $\text{B}_{12}\text{H}_{12}^{2-}$
- (ii) $\text{B}_{12}\text{H}_{12}^{2+}$
- (iii) $\text{B}_{12}\text{H}_{12}^+$
- (iv) $\text{B}_{12}\text{H}_{12}$

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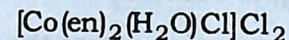
(3)

(f) In the extraction of pure Ni, the following reaction is utilized



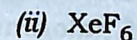
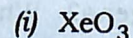
In the above reaction, what are X and temperature Y respectively?

(g) Give the IUPAC name of the following compound :



2. Answer the following questions : 2×4=8

(a) Write the syntheses of the following compounds :



(b) $\text{N}(\text{CH}_3)_3$ is pyramidal but $\text{N}(\text{SiH}_3)_3$ is planar. Explain.

(c) Define the term 'ligand'. What feature(s) would be necessary for a molecule or ion to act as a bidentate ligand?

(d) Copper and iron have several oxidation states, whereas zinc exists in only one. Justify.

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(Turn Over)

(4)

3. (a) How is it possible to form interhalogen compounds? Explain the structures and bondings in ClF_3 , ClF_5 and IF_7 . 2+3=5

(b) For S_4N_4 , answer the following : 1+1+1+2=5

(i) One method of preparation of it

(ii) One reaction where the heterocyclic ring is retained

(iii) One reaction where the smaller ring is formed

(iv) At least four resonance structures of the molecule

Or

What are pseudohalogens? Why are they so called? Write the similarities between the reactions of halogens and pseudohalogens. 1+2+2=5

(c) Name one important ore of manganese. Describe the extraction of chromium from its ore. 1+4=5

Or

(i) Give reasons why a solution of Fe^{3+} is slightly acidic in nature. 2

(ii) Mention two important alloys of copper and write their uses. 3

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(Continued)

(5)

4. (a) (i) What are silicones? Give a brief account of synthesis, structure and important applications of silicones. What is silly putty? 5+1=6

(ii) The hydration energy of group 2 metals is much greater than group 1 metals and among group 2 metals beryllium has the maximum. Give reasons to justify this statement. 4

Or

(i) How does SiH_4 chemically differ from CH_4 ? Give the structural representations of $\text{Si}_3\text{O}_9^{6-}$ and $\text{Si}_6\text{O}_{18}^{12-}$. 2+3=5

(ii) How are alkali metals generally characterized? What are different oxides formed by alkali metals? Write a brief account of their stability. 5

(b) (i) How can you explain the following properties of metals? 5

Brightness, malleability, catalytic activity, semiconductor property and ability to form coordination compounds

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(Turn Over)

(6)

(ii) What is inert pair effect? Explain why, unlike other elements in group 14, Sn and Pb are more stable in their bivalent state than the tetravalent state.

5

Or

Give a comparative study of the following properties of first row transition elements : $4+3+3=10$

- (i) Oxidation state
 - (ii) Magnetic properties
 - (iii) Catalytic behaviour
- (c) (i) Discuss the preparations and structures of $\text{Fe}(\text{CO})_5$, $\text{Fe}_2(\text{CO})_9$ and $\text{Fe}_3(\text{CO})_{12}$. $3+3=6$
- (ii) Draw the structure of trisoxalato chromate (III) anion. Would you expect this complex to show any isomerism? Suggest a preparative method for $\text{K}_3[\text{Cr}(\text{ox})_3] \cdot 3\text{H}_2\text{O}$. $2+2=4$

Or

(i) A compound $\text{Co}(\text{en})_2(\text{NO}_2)_2\text{Cl}$ has been prepared in three isomeric forms A, B and C. A undergoes no reaction with AgNO_3 or en and

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(Continued)

(7)

is optically active, B reacts with AgNO_3 , but not with en and is optically inactive. C is optically active and reacts with both AgNO_3 and en. Identify A, B and C.

[en = ethylenediamine]

6

(ii) Give an account of occurrence and the principle of extraction of nickel. 4

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3 (Sem-4) CHM M 2