

2018

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) Which one of the following is pseudo-halide?

(i) ICl

(ii) IF₅

(iii) CN⁻

(iv) I₃⁻

(b) XeO₃ is prepared by the

(i) direct combination of Xe and O₂

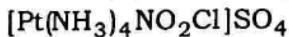
(ii) hydrolysis of XeF₄

(iii) oxidation of XeO₂

(iv) hydrolysis of XeF₆

- (c) Which of the following compounds has a cage structure?
- (i) Borazine
 - (ii) B_2H_6
 - (iii) P_4O_{10}
 - (iv) Phosphazine
- (d) Among the metals Mn, Fe, Co and Ni, the ones those would react in their native forms directly with CO giving metal carbonyl compounds are
- (i) Co and Mn
 - (ii) Mn and Fe
 - (iii) Fe and Ni
 - (iv) Ni and Co
- (e) In which one of the following is a metal-metal bond present?
- (i) Cupric chloride
 - (ii) Mercurous chloride
 - (iii) Stannous chloride
 - (iv) Mercuric chloride
- (f) Write the possible geometrical isomers for octahedral $[Co(OX)(PMe_3)_2NH_3Cl]$.

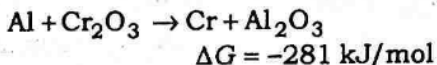
- (g) Give the IUPAC name of the following compound :



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

- (a) Why transition metal exhibits highest oxidation state in oxides and fluorides?

- (b) The reaction



is thermodynamically feasible but it does not take place at room temperature. Why?

- (c) Write the reaction for preparation of 1,7-B₁₀H₁₀C₂RR'.

- (d) Which is more stable—chloric acid or perchloric acid? Justify.

3. Answer any *three* from the following questions : 5×3=15

- (a) Discuss the nature of bonding in borazine. Justify why borazine does not show true aromatic character. 3+2=5

- (b) Which special properties of Au make it so important in human civilization? How does gold occur in nature and how is it commercially extracted? 2+3=5

- (c) Discuss the oxidation states of the elements of the first transition series. Indicate common oxidation states and their relative stability for the metals Cr—Cu. 5
- (d) Briefly describe the preparation, structure and properties of xenon fluorides. 5
- (e) Write the formula for the complex dichlorobis(ethane-1,2-diamine)cobalt(III) ion. Draw its geometrical and optical isomers. Why is geometrical isomerism not possible in tetrahedral complexes having two different types of unidentate ligands with the central metal ion? 1+2+2=5

4. Answer any *three* from the following questions : 10×3=30

- (a) Explain the different types of isomerism exhibited by coordination compounds in square planar, tetrahedral and octahedral geometry. 10
- (b) (i) Transition metals show variable oxidation states. Give examples of two different oxidation states shown by Mn in its compounds. In each case, give the oxidation state,

and an example of a compound containing Mn in that oxidation state.

3

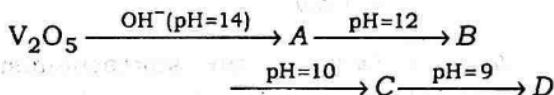
(ii) Transition metals and their compounds are frequently used as catalysts. Name the catalysts employed in the following processes :

3

Haber process for the manufacture of ammonia, hydrogenation of carbon-carbon double bonds and contact process for the manufacture of sulphuric acid.

(iii) Identify A, B, C and D in the following reactions :

4



(c) (i) Compare the magnetic behaviour of the oxides and mixed oxides of iron with those of Ruthenium and Osmium.

5

(ii) Give the method of preparation, properties and structure of S_4N_4 .

2+1+2=5

(d) Explain the following : 2×5=10

- (i) Chromium is a typical metal while mercury is a liquid metal.
- (ii) Zn readily liberates H_2 from cold dil. H_2SO_4 but not from cold conc. H_2SO_4 .
- (iii) Transition elements and *d*-block elements.
- (iv) Cu^+ ion has $3d^{10}4s^0$ configuration and colourless but Cu_2O is red and Cu_2S is black.
- (v) Enthalpies of atomization of transition elements are higher than those of alkali and alkaline earth metals.

(e) (i) Describe the stereochemistries of Zn and Cd compounds. 5

- (ii) Will Hg_2^{2+} ion disproportionate in aqueous solution into Hg^{2+} and Hg^0 ? Given that

$$E_{Hg_2^{2+}/Hg^0}^\circ = 0.7960 \text{ V}$$

$$E_{Hg^{2+}/Hg_2^{2+}}^\circ = 0.9110 \text{ V}$$

$$E_{Hg^{2+}/Hg^0}^\circ = 0.8535 \text{ V}$$

5

- (f) (i) What are silicates? Draw the structure of four different types of silicates and give the name and formula of each type. 6
- (ii) Draw and describe the structure of the compound formed by CH_3COO^- with chromium. 4
