

2015

CHEMISTRY — HONOURS

Fourth Paper

(Group – A)

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*

CHT – 21a

Unit – I

Answer *any three* questions

1. (a) Compare the hydrolytic behaviour of NCl_3 , PCl_3 and AsCl_3 .
Give necessary equation. 3
- (b) Electron Affinity of Fluorine is less than chlorine but Fluorine is stronger oxidising agent than chlorine — Explain. 2
2. (a) Explain why :
 - (i) Sodium in liquid Ammonia is blue in colour and paramagnetic.
 - (ii) The B–F bond in BF_4^- is longer than that of in BF_3 . $1\frac{1}{2}+1\frac{1}{2}$
- (b) BeO is sparingly soluble in water but readily soluble in presence of BeSO_4 — Explain. 2
3. (a) NO_2 dimerise readily but ClO_2 does not — Explain. 3
- (b) Compare the oxidising behaviour of Perchlorate and Perbromate ions. 2
4. (a) $\text{N}(\text{CH}_3)_3$ and $\text{N}(\text{SiH}_3)_3$ gives different products on reaction with HCl — Explain. 3
- (b) Explain with reason the ionisation of TlI_3 in acid medium. 2
5. (a) Compare with reason the differences in the elemental state of Oxygen and Sulphur. 3
- (b) Amongst inert gases Xenon is most suitable to form chemical compounds. — Explain. 2

Unit – II

Answer *any two* questions

6. (a) Draw the MO of HF and find out the number of nonbonded electrons. 3
- (b) CO and N_2 are isoelectronic but they differ greatly in donor properties — Explain. 2
7. (a) What are chelates ? Mention one application of it each in qualitative and quantitative analysis. 3
- (b) Distinguish between ambidentate and polydentate ligand with examples. 2

[Turn Over]

8. (a) (i) Draw and mention the type of isomers of the complex $[\text{Co}(\text{NO}_2)_3(\text{NH}_3)_3]$.

(ii) Write the IUPAC name of the complex $[\text{Co}(\text{NH}_3)_6][\text{Co}(\text{NO}_2)_6]$.

(iii) Although HF is monoprotic acid still it forms bi-salts
— Explain. 1+1+1

(b) How and under what condition can an insulator be converted to semiconductor ? 2

CHT - 21b

Unit - I

Answer *any three* questions

9. (a) Discuss the structure and bonding of diborane in the light of MO Theory. 3

(b) Complete the following reactions :



10. (a) Discuss the structure and bonding in S_4N_4 molecule. 3

(b) Explain why polythiazyl act as one-dimensional metallic conductor. 2

11. (a) Why mica is cleaved into sheets but asbestos in fibres ? 3

(b) Why boron nitride is called Inorganic Graphite ? 2

12. (a) What are Freons ? What is its impact on ozone layer ? 3

(b) Mention two similarities between SCN^- and I^- . 2

13. (a) Explain why :

(i) NaN_3 is more stable than HN_3 .

(ii) Solubility of I_2 in water increases in presence of KI. 3

(b) How do you isolate Argon from air and state one use of it ? 2

Unit - II

Answer *any two* questions

14. (a) For the redox reaction



Calculate the equilibrium constant value

[Given $E^\circ \text{MnO}_4^- / \text{Mn}^{2+} = +1.52$ volt;

$E^\circ \text{Fe}^{3+} / \text{Fe}^{2+} = +0.77$ volt.] 3

(b) What will be the effect on the potential of the $\text{Fe}^{3+} / \text{Fe}^{2+}$ system on adding — 2

(i) NH_4HF_2

(ii) 2, 2' bipyridyl ?

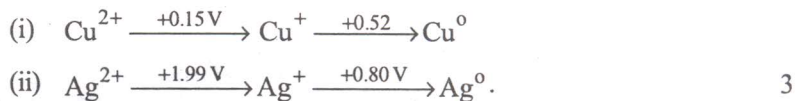
15. (a) Justify that CuS is precipitated in acidic medium (HCl) when H₂S gas is passed through Cu²⁺ solution while ZnS is precipitated in basic medium (NH₄OH). 3

$$\left[K_S(\text{CuS}) = 8.0 \times 10^{-36} \right. \\ \left. K_S(\text{ZnS}) = 3 \times 10^{-22} \text{ at } 25^\circ \text{C} \right].$$

(b) According to reduction potential value of Cu²⁺/Cu⁺ (E° = +0.15V) and $\frac{1}{2} \text{I}_2/\text{I}^-$ (E° = +0.54 V) system, Cu²⁺ should not oxidise I⁻. Explain how can iodometric titration of Cu²⁺ is possible.

$$\left[K_S(\text{CuI}) \approx 1 \times 10^{-12} \text{ at } 25^\circ \text{C} \right]. \quad 2$$

16. (a) From Frost diagram compare the stability of Cu⁺ and Ag⁺ in solution.
Given



(b) Balance the following equation by Ion-electron Method : 2

