

Total No. of Questions : 9]
(2041)

[Total No. of Printed Pages : 8

**UG (CBCS) IIIrd Year (Annual)
Examination**

2521

B.Sc. CHEMISTRY

**(Chemistry of Transition and Inner Transition
Elements, Coordination Chemistry,
Organometallics, Acids and Bases)**

(DSE-2B)

Paper : CHEM 304 TH

Time : 3 Hours]

[Maximum Marks : 50

Note :- (i) Attempt *five* questions in all, selecting *one* question from each Section.

(ii) All questions carry equal marks. Section E is compulsory.

Section-A

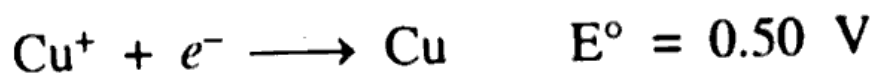
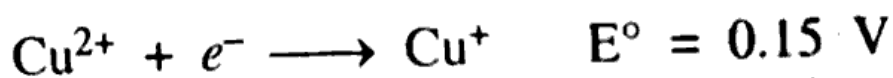
- (a) Describe the oxidizing character of KMnO_4 in acidic, basic and neutral conditions.
- (b) $4s$ -subshell is filled prior to $3d$ but on ionization $4s$ electrons are removed first. Explain.

CH-352

(1)

Turn Over

(c) The reduction potentials are :



Draw the Latimer diagram and calculate the value of reduction potential for the following reaction :



2. (a) What is Lanthanide Contraction ? Discuss the cause of lanthanide contraction and its effect.

(b) Explain the ion exchange method for the separation of lanthanides.

(c) Explain the following properties of actinides :

(i) Magnetic properties

(ii) Colour of ions 4,3,3

Section-B

3. (a) What are the basic postulates of Valance Bond Theory (VBT) ?

(b) What is the difference between inner and outer orbital complexes ? Explain by taking suitable examples.

- (c) Draw the various possible stereoisomers for the complex $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ and explain with structures, which one of these will show optical isomerism. 3,3,4
4. (a) What is Zeise Salt ? Draw its structure and discuss the salient features of this structure.
- (b) What do you mean by hapticity of a ligand ? How is it designated ? Explain with example.
- (c) Define the term EAN. Explain with suitable examples. 5,3,2

Section-C

5. (a) Define crystal field splitting energy and discuss the crystal field splitting of d-orbitals in case of octahedral complexes.
- (b) $[\text{CoF}_6]^{3-}$ is paramagnetic but $[\text{Co}(\text{NH}_3)_6]^{3+}$ is diamagnetic though both are octahedral complexes. Explain on the basis of crystal field theory.

(c) Calculate the CFSE for the following systems :

(i) d^4 -octahedral (high spin)

(ii) d^7 -octahedral (low spin) 4,3,3

6. (a) Explain the factors affecting the magnitude of crystal field splitting.

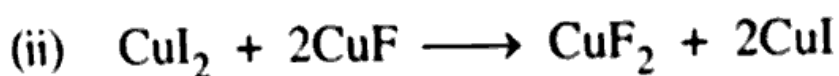
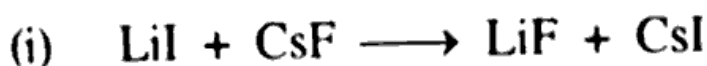
(b) All the tetrahedral complexes are high spin complexes. Explain.

(c) Calculate CFSE of $[\text{NiCl}_4]^{2-}$. 6,2,2

Section-D

7. (a) What do you understand by HSAB principle ?

Predict the feasibility of the following reactions on the basis of HSAB principle :

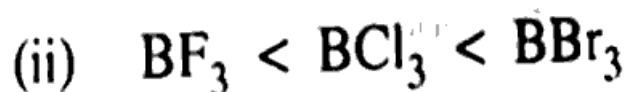
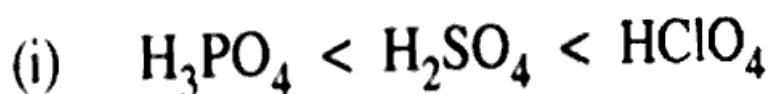


(b) What are Amphoteric Substances ? Explain with examples giving reasons.

(c) Arrange the following acids in order of increasing acidic strength : HClO , HClO_2 , HClO_3 , HClO_4 giving suitable reasons. 4,3,3

8. (a) What are leveling and differentiating solvents ?
Explain with examples.

(b) Define Lewis concept of acids and bases with examples. Explain the trend of acidic strength of the following molecules :



(c) Arrange the following molecules in the decreasing order of their basic strength with explanation : $\text{NH}_3, \text{PH}_3, \text{AsH}_3$ 3,4,3

Section-E

(Compulsory Question)

9. Multiple choice questions/True or False/Fill in the blanks :

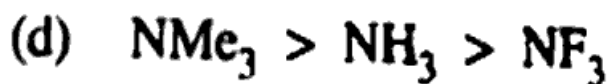
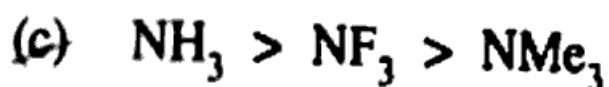
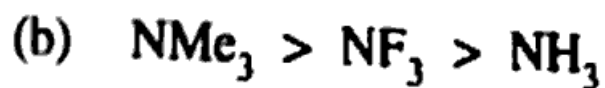
(i) Spin only magnetic moment of Ni^{2+} and Fe^{3+} is and respectively.

(ii) $\text{La}(\text{OH})_3$ is more basic than $\text{Lu}(\text{OH})_3$.

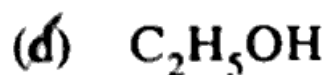
(True/False)

- (iii) Which of the following square planar complex does not exhibit geometrical isomerism ?
- (a) MABCD
 - (b) MA_2BC
 - (c) MA_4
 - (d) MA_2B_2
- (iv) Which of the following obeys Effective Atomic Number (EAN) rule ? <https://www.hpboardonline.com>
- (a) $[NiCl_2(NH_3)_2]$
 - (b) $[CoCl_4]^{2-}$ ✓
 - (c) $[MnBr(CO)_5]$
 - (d) $[Pt(NH_3)_4]^{2+}$
- (v) The strong field Co^{3+} ion complex has unpaired electrons.
- (vi) CFSE for d^5 tetrahedral complex is :
- (a) $4 Dq$
 - (b) $-8 Dq$
 - (c) $0 Dq$
 - (d) $-12 Dq$

(vii) The basic character of NMe_3 , NH_3 and NF_3 follows the order :

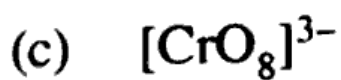
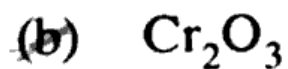


(viii) Which of the following is not a Lewis base ?



(ix) In gas phase the structure of ferrocene is eclipsed while in condensed phase the structure of ferrocene is staggered. (True/False)

(x) Which of the following is not an example of peroxo compound ?



1×10=10

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