

Roll No. 2180190017

Total No. of Questions : 9] [Total No. of Printed Pages : 8
(2041)

**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

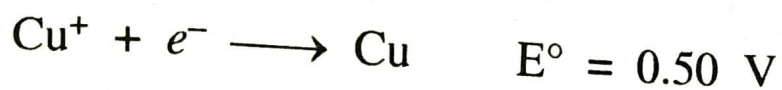
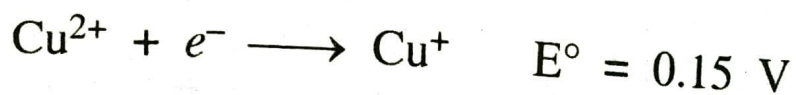
- (a) Describe the oxidizing character of KMnO_4 in acidic, basic and neutral conditions.
- (b) $4s$ -subshell is filled prior to $3d$ but on ionization $4s$ electrons are removed first. Explain.

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



3. (a) What are the basic postulates of Valence 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.

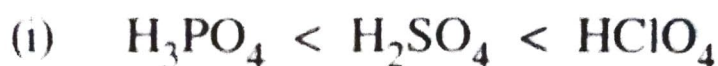
(c) Arrange the following acids in order of increasing acidic strength : HClO , HClO_2 , HClO_3 , HClO_4 giving suitable reasons.

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 : NH_3 , PH_3 , 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) MA₂BC

(c) MA₄

(d) MA₂B₂

(iv) Which of the following obeys Effective Atomic Number (EAN) rule ?

(a) [NiCl₂(NH₃)₂]

(b) [CoCl₄]²⁻

(c) [MnBr(CO)₅]

(d) [Pt(NH₃)₄]²⁺

(v) The strong field d^5 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 :

- (a) $\text{NF}_3 > \text{NH}_3 > \text{NMe}_3$
- (b) $\text{NMe}_3 > \text{NF}_3 > \text{NH}_3$
- (c) $\text{NH}_3 > \text{NF}_3 > \text{NMe}_3$
- (d) $\text{NMe}_3 > \text{NH}_3 > \text{NF}_3$

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

- (a) NH_3
- (b) CN^-
- (c) BCl_3
- (d) $\text{C}_2\text{H}_5\text{OH}$

(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 ?

- (a) CrO_5
- (b) Cr_2O_3
- (c) $[\text{CrO}_8]^{3-}$
- (d) CrO_4

1×10=10

Ac	3			89
Th	3			90
Pa	3			91
U	3			92
ESNP	3			93
PO	2	4	56	94
Am				
Cm				
Bk				
Cf				
Es				
F				
M				
N				
Lr				

$[\text{Rn}] 7s^2 6d^1 5f^0$ D
 $[\text{Rn}] 7s^2 6d^1 5f^1$ P
 $[\text{Rn}] 7s^2 6d^0 5f^3$ D
 $[\text{Rn}] 7s^2 6d^0 5f^1$ h

$[\text{Rn}] 7s^2 6d^1 5f^0$

$[\text{Rn}] 7s^2 5f^{14} 6d^1$