

BITS PILANI -DUBAI CAMPUS,KNOWLEDGE VILLAGE ,DUBAI
I YEAR II SEMESTER,2006-2007

COMPREHENSIVE EXAMINATION

Course Title :Chemistry II
Date: 30.5.2007
Time:3 hrs

Course No:CHEMUC142
Max Marks:120
Weightage:40%

Note:1.Answer Part - A , B and C separately.

2.Answer briefly all parts of a question in continuation.

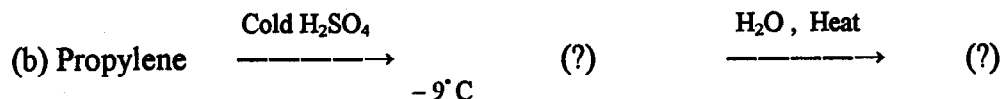
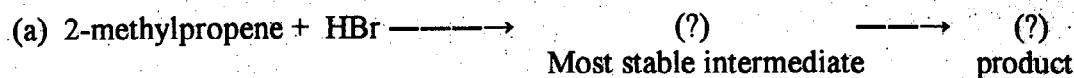
3.Useful atomic numbers:

C(6),F(9),Br(35),Cr(24),Mn(25),Co(27),Fe(26),Ni(28),Cu(29),Zn(30),Pt(78)

PART -A

1. (i) Write the number of B—B , B—H and B—H—B bonds in Pentaborane -9. [3]
(ii) Explain why Cu^{2+} does not form a regular octahedral complex whereas Ni^{2+} does ? [2]
(iii) For an octahedral Mn^{3+} ion, the mean pairing energy is about $28,000 \text{ cm}^{-1}$ and Δ_o value is $38,500 \text{ cm}^{-1}$. Calculate the CFSE for this complex ion corresponding to high spin and low spin state. [5]
- 2.(i) On the basis of CFT, predict whether the following ions are square planar / octahedral / tetrahedral. Show the distribution of d electrons of the central metal atom in the splitted d-orbitals. (a) $[\text{Fe}(\text{CN})_6]^{3-}$ (b) $[\text{Pt}(\text{en})_2]^{2+}$ [5]
(ii)(a) Starting with benzene , outline a synthesis of each of the following isopropyl benzene and acetophenone
(b) Write clearly how the electrophile is being generated in electrophilic aromatic chlorination reaction. [3+2]
- 3.(i)For the given nucleophilic substitution reaction
 $\text{CH}_3\text{Cl} + \text{OH}^- \rightarrow (?)$
(a) write the rate expression and kinetics (b) effect of doubling OH^- concentration
(c) stereochemistry of the reaction (d) mechanism of the reaction [6]
(ii) Give the products that you would expect to be formed in the reaction given below. Predict the mechanism ($\text{S}_{\text{N}}1 / \text{S}_{\text{N}}2 / \text{E}1 / \text{E}2$) by which the product is formed and the relative amount of each product. (major/minor) [4]
(a) Tertiary butyl bromide + sodium ethoxide $\xrightarrow[55^\circ\text{C}]{\text{C}_2\text{H}_5\text{OH}}$ (?)
(b) Octadecyl bromide + methoxide ion $\xrightarrow[60^\circ\text{C}]{\text{CH}_3\text{OH}}$ (?)

4. Complete the following reactions [missing thing is indicated as (?)] [10]
Name of the products should be written.



PART-B

- 1.(i) Write all the free radicals in the order of increasing stability that can be obtained from 2-methyl butane by H- abstraction. [3]
(ii) Chlorination of 2-methyl butane gives 15% of 1-chloro-3-methyl butane and 33% of 2-chloro-3-methyl butane – How will you justify the difference in quantities of products formed. [3]
(iii) What is the product obtained when propene is reacted with hydrogen bromide in presence of an organic peroxide? Suggest a mechanism for the product formed. [4]
- 2.(i) Find out which of the following compounds are aromatic/ non aromatic? Justify your answer. [8]
(a) Naphthalene (b) Tropyliene (c) Thiophene (d) Azulene
- (ii) Write the structure of following chelating ligands and show their coordination sites. [2]
(a) 1,10 -Phenanthroline (b) Ethylenediaminetriacetate ion
- 3.(i) Write the structure and type of geometry shown by [Co(en)₂Cl₂]. [5]
(ii) Calculate the crystal field stabilization energy for the central metal ion of the following complex ions. [CoCl₄]²⁻ and [FeCl₄]⁻ in tetrahedral ligand field. Find out the spin only magnetic moment also. [5]
- 4.(i) Predict the product and mechanism of the reaction. [5+5]
(C₂H₅)₃-CCl + H₂O \longrightarrow (?)
(ii) Write the product and mechanism of the reaction
(CH₃CH₂)₃-CCl + NaOH $\xrightarrow[50^\circ\text{C}]{\text{CH}_3\text{OH}}$ (?)

PART-C

1.(i) On the basis of VB theory predict the hybridization, oxidation state of the central metal and the presence of number of unpaired electrons for the complex $[\text{CoF}_6]^{3-}$. [4]

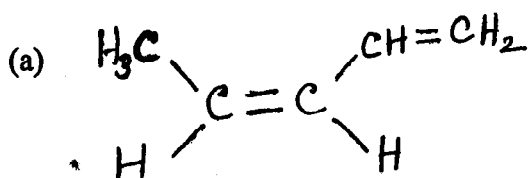
(ii) Give the IUPAC name / molecular formula for the given complexes [2]

(a) $[\text{Fe}(\text{EDTA})]^-$ (b) Potassium pentacyanonitrosylcobalt(III)

(iii) Why diborane compound cannot be methylated completely and state the number $3\text{c}-2\text{e}^-$ and $2\text{c}-2\text{e}^-$ bonds present in the same molecule. [4]

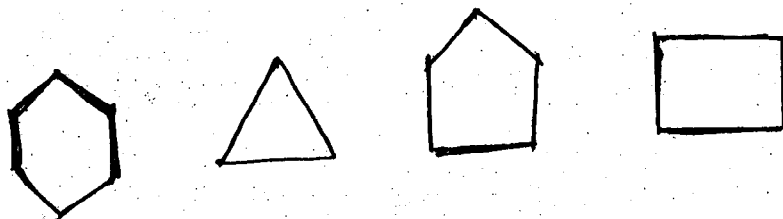
2.(i) Draw the structure of the chiral drug **Methyldopa** and mention its use. Specify the functional groups present in it. [6]

(ii) Write the IUPAC name with (E)-(Z) designation and structural formula for the following [4]



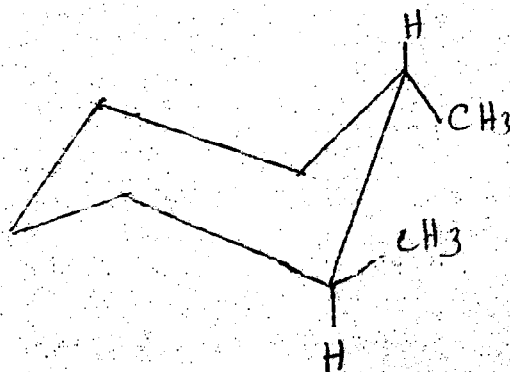
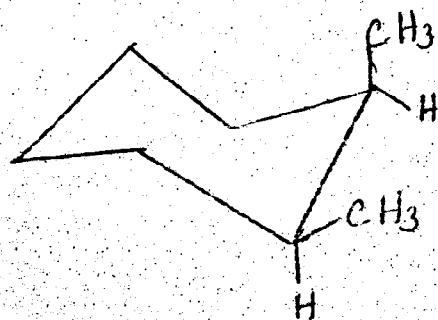
(b) (E)-1-Bromo-1,2-dichloroethene

3.(i) Arrange the molecules in the increasing order of their stability and give suitable reason for your answer. [5]

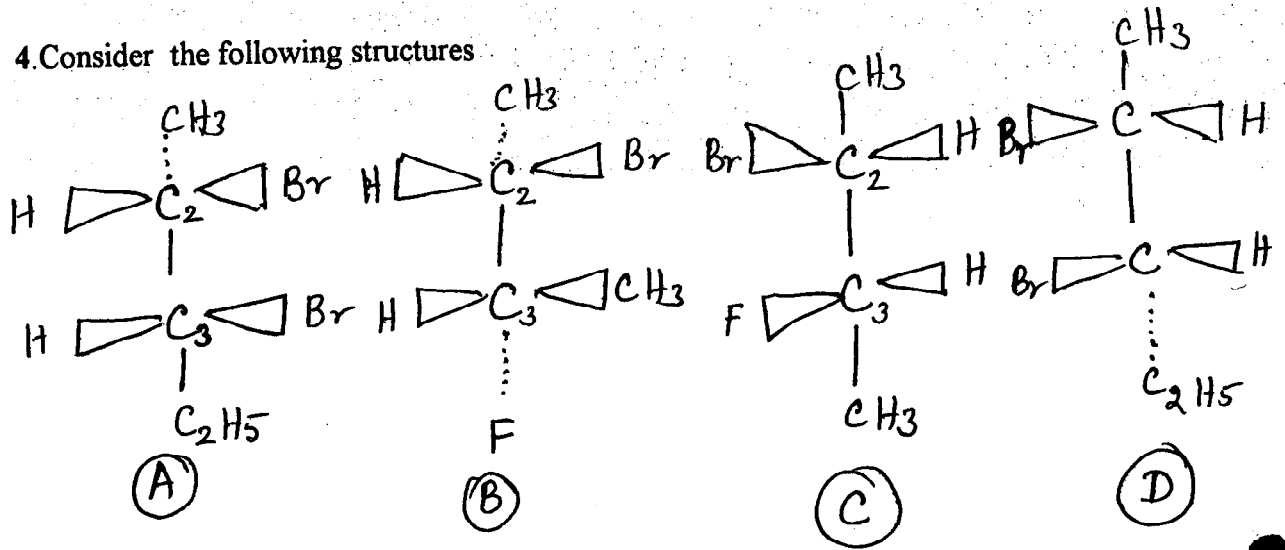


(ii) What are the differences between enantiomer and conformational isomer? [3]

(iii) State whether the following conformational structures as cis or trans [2]



4. Consider the following structures



(i) Identify the relation between A&D and B&C as diastereomer or enantiomer. [2]

(ii) Assign R and S notation for C2 and C3 atoms present in A and B molecules [4]

(iii) What is the condition to be satisfied for a reaction to proceed with retention of configuration? Give an example. [4]

BITS PILANI -DUBAI CAMPUS,KNOWLEDGE VILLAGE ,DUBAI
I YEAR SECOND SEMESTER 2006-2007

Test -2 (Open book)
Course Title :Chemistry I (CHEM UC142)

Date: 13.5.2007

Time: 50 min

Total Marks: 60

Weightage: 20%

-
1. Answer all questions sequentially.
 2. Overwriting is taken as wrong answer.
 3. Only prescribed text book is allowed.
-

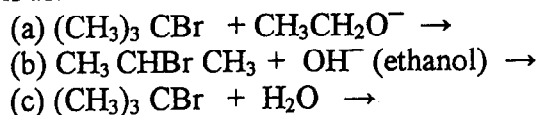
1.(i) Rank the following in order of decreasing nucleophilicity .Give reasons for your choice .



(ii) Write the structure and name of the major and minor products formed when 2-bromopentane undergoes dehydrohalogenation in the presence of potassium ethoxide.

(iii) Give structures and names of alkenes expected from dehydrohalogenation by strong base of (a) 1-chloropentane (b) 3-chloro-2-methylbutane
(c) 1-chloro-2,2- dimethylpropane.

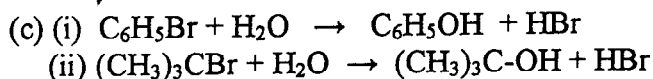
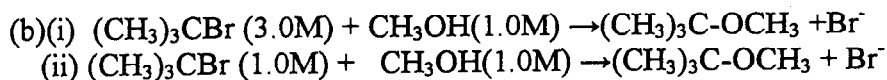
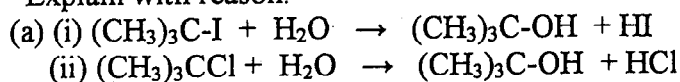
(iv) In each case mention the mechanism ($\text{S}_{\text{N}}1$, $\text{S}_{\text{N}}2$,E1 or E2) by which the product is formed.



(4+4+6+6M)

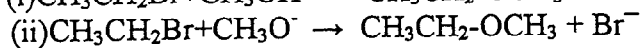
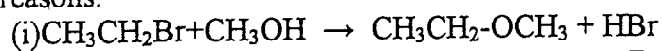
2. (i) Among ethyl bromide and neopentyl bromide which will react rapidly?
Explain with reason.

(ii) Of the following which $\text{S}_{\text{N}}1$ reaction will take place more rapidly?
Explain with reason.



(iii) When t-butyl iodide undergoes solvolysis with ethanol and H_2O , the rate of solvolysis increases with decrease in concentration of ethanol- Why?

(iv) Which of the following two S_N2 reactions will proceed fast - Give reasons.



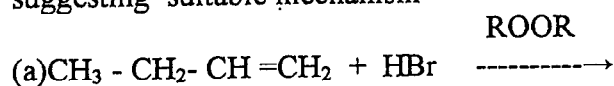
(4+6+5+5M)

3.(i) Give chain mechanism for the following reactions

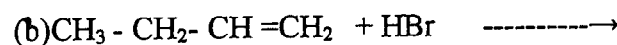
(a) Formation of 1-chloro butane (b) Formation of polyvinylchloride

(ii) Differentiate between Markovnikov's addition and Anti Markovnikov's addition reactions

(iii) Write the products for the following reactions and justify your answer by suggesting suitable mechanism



no ROOR



(10+3+7M)

BITS PILANI -DUBAI CAMPUS,KNOWLEDGE VILLAGE ,DUBAI
I YEAR SECOND SEMESTER,2006-2007

A

QUIZ II (Closed Book)

Course Title :Chemistry II
Date: 17.4.2007
Time:30 min

Course No:CHEMUC142
Total Marks:30
Weightage:10%

- NOTE :**
- 1.Answer all the questions**
 - 2. For multiple choice questions tick and underline the correct answer.**
 - 3.Show workings where ever necessary.**
 - 4.Overwriting will be treated as wrong answer.**
 - 5.Question paper contains 4 pages.**

Name of the Student : _____

ID No: _____

Section : _____

Set : **A**

RECHECK REQUEST:

(2)

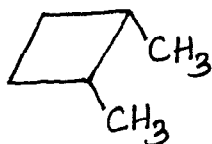
Useful data:

Useful atomic numbers : H =1, C=6, N=7, O=8, Cl=17, Br=35, I =53

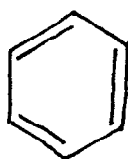
1. Consider (R) and (S)-2-butanol. Which physical property distinguishes the two compounds? (2M)

2. Which one of the following molecules does not contain a plane of symmetry? (2M)

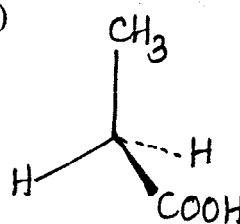
(a)



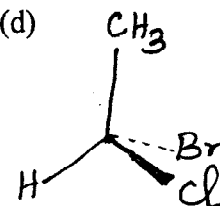
(b)



(c)

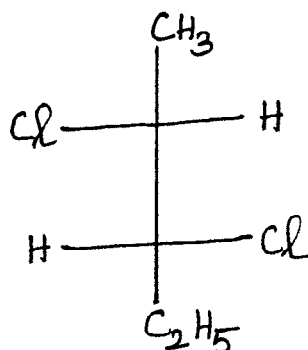


(d)

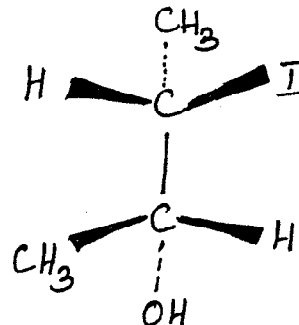


3. Assign (R) and (S) designations to each of the following compounds. (2M)

(a)



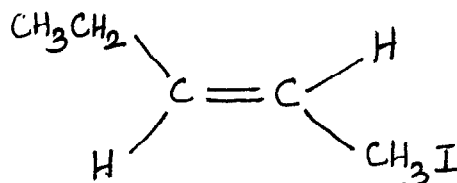
(b)



4. Name the chiral drug that is effective against typhoid fever. Give its structure. (2M)

(3)

5. Write the structural formula and name for the isomers given below. (2M)
(a) (Z)-3-chloro-4-methyl-3-hexene (b)



6. Among anti, gauche and eclipsed conformations of 1,2-dichloroethane, the most stable conformation is _____ (1M)

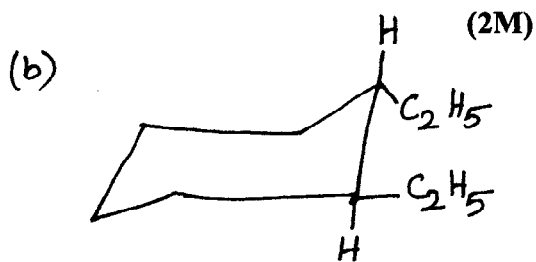
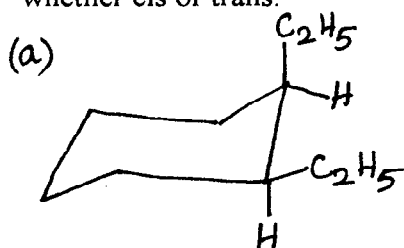
7. _____ and _____ cause the boat conformation to have higher energy than chair conformation. (2M)

8. Among axial- tert-butyl cyclohexane and equatorial - tert - butyl cyclohexane the most stable one is _____ (1M)

9. In cis-1,4-dimethylcyclohexane, two equivalent chair conformations exist, they are _____ and _____ (2M)

10. Draw the most stable conformation of trans -1-tert-butyl -3-methyl cyclohexane. (2M)

11. Consider each of the following conformational structures and state whether cis or trans. (2M)



12. The order of increasing reactivity of alkenes is (2M)

- (a) $\text{CH}_2=\text{CH}_2 < (\text{CH}_3)_2\text{C}=\text{CH}_2 < \text{CH}_3\text{CH}=\text{CHCH}_3$
 (b) $\text{CH}_3\text{CH}=\text{CHCH}_3 < (\text{CH}_3)_2\text{C}=\text{CH}_2 < \text{CH}_2=\text{CH}_2$
 (c) $(\text{CH}_3)_2\text{C}=\text{CH}_2 < \text{CH}_3\text{CH}=\text{CHCH}_3 < \text{CH}_2=\text{CH}_2$
 (d) $\text{CH}_2=\text{CH}_2 < \text{CH}_3\text{CH}=\text{CHCH}_3 < (\text{CH}_3)_2\text{C}=\text{CH}_2$

13. Anti Markonikov's addition occurs when alkene is treated with _____

in presence of _____ (2M)

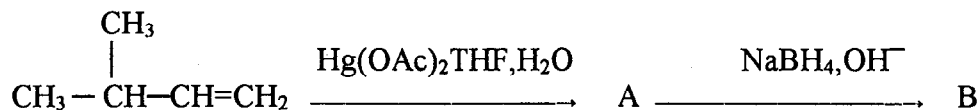
14. Which of the following compound will produce tert-Butyl alcohol when it undergoes hydration in presence of an acid (2M)

- (a) $\text{CH}_3-\text{C}(\text{CH}_3)=\text{CH}_2$ (b) $\text{CH}_2=\text{CH}-\text{CH}_2\text{CH}_3$ (c) $\text{CH}_3-\text{CH}=\text{CH}-\text{CH}_3$
 (d) $\text{CH}_3-\text{CH}_2-\text{CH}=\text{CH}_2$

15. The major product obtained in the bromination of alkene in presence of (2M)

a non aqueous solvent is _____ and in an aqueous solvent is _____.

16. What is A and B ? (2M)



A =

B =

BITS PILANI -DUBAI CAMPUS,KNOWLEDGE VILLAGE ,DUBAI
I YEAR II SEMESTER,2006-2007

Test - I (Closed Book)

Course Title :Chemistry II

Course No:CHEMUC142

Date: 25.03.2007

Max Marks:60

Time:50 min

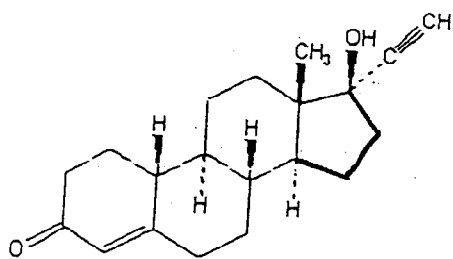
Weightage:20%

Note:1. Answer all the questions sequentially 2. Question paper has 2 pages.

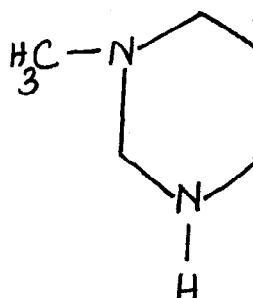
3. Atomic numbers:H=1, C=6,N=7, O=8, Cl=17, Br=35, S=16

1.(i) Write the functional groups present in the following molecules. (2+2M)

(a)

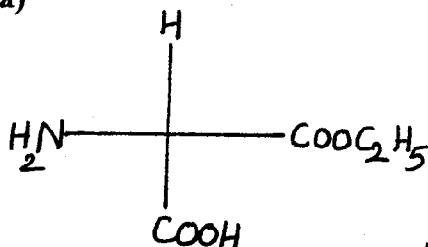


(b)

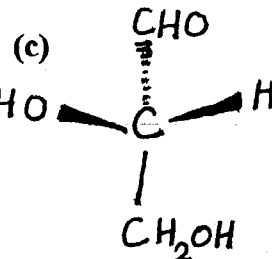
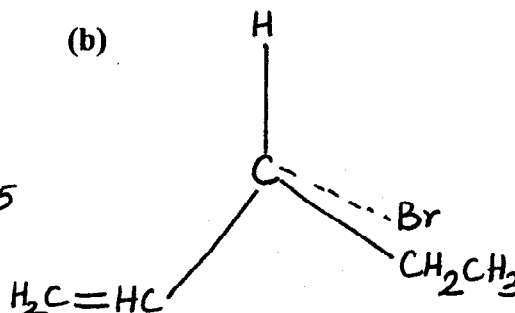


(ii) Designate as R or S configuration clearly indicating the priorities of the Substituents. (6M)

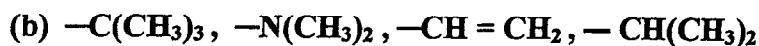
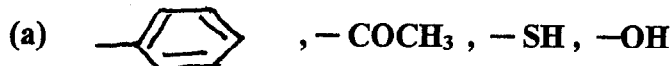
(a)



(b)

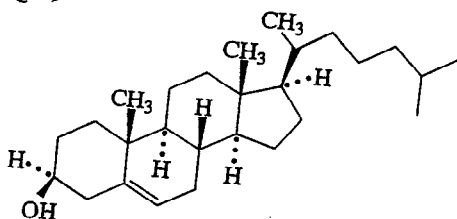


(iii) List the substituents in each of the following sets in order of priority from highest to lowest. (4M)

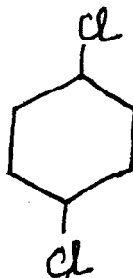


(iv) Write the number of chiral atoms in each of the following compounds (6M)

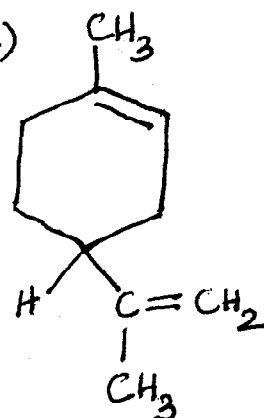
(a)



(b)



(c)



2.(i) Write the structural formula of (a) 2,3,5-Trimethyl-4-propyl heptane. (2+2M)
(b) Ethyl-2-bromobutan-1-oate

(ii) Write the structure and IUPAC names of 1°, 2°, 3° alcohols having molecular formula C₅H₁₁OH. (6M)

(iii) With reference to the group 13 elements account for the following (2+2M)
(a) Thallous compounds are more stable than Thallic compounds
(b) The metallic radii of the atoms do not increase regularly.

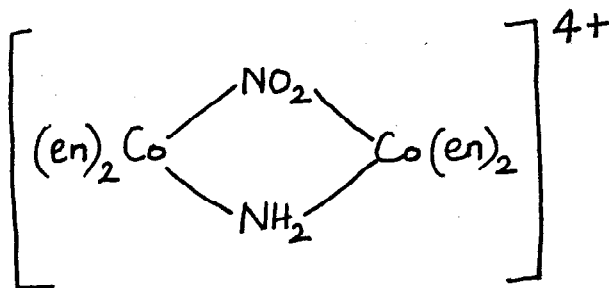
(iv) Write the number of different types of bonds (B—B, B—H, B—H—B, B—B—B) and the number of electrons involved in each type present in Pentaborane -11. (6M)

3.(i) Draw the structures and clearly indicate the donor atoms of the chelating ligands. (2+2M)
(a) EDTA (b) Dimethyl glyoxime

(ii) Write any three biologically important chelating compounds and mention their application (6M)

(iii) Give any two differences between geometrical and optical isomerism. Draw the possible isomers of the given complexes (2+3M)
(a) [Co(NH₃)₄Br₂] (b) Cu - glycinate complex

(iv) (a) Write the conditions for a complex to show optical isomerism (3+2M)
(b) Draw the enantiomers of



BITS PILANI-DUBAI CAMPUS,KNOWLEDGE VILLAGE ,DUBAI
I YEAR SECOND SEMESTER,2006-2007

A

QUIZ I (Closed Book)

Course Title :Chemistry II
Date: 6.03.2007
Time:30 min

Course No:CHEMUC142
Total Marks:30
Weightage:10%

- NOTE :**
- 1.Answer all the questions**
 - 2. For multiple choice questions tick and underline the correct answer.**
 - 3.Show workings where ever necessary.**
 - 4.Overwriting will be treated as wrong answer.**
 - 5.Question paper contains 4 pages.**

Name of the Student : _____

ID No: _____

Section : _____

Set : **A**

RECHECK REQUEST:

(2)

Useful data:

Useful atomic numbers :Cr(24),Mn(25),Co(27),Fe(26),Ni(28),Cu(29),Zn(30),Ti(22)

1. The CFSE for a low-spin octahedral complex of a d^7 ion is
(a) $-2.4 \Delta_o$ (b) $-1.8 \Delta_o$ (c) $-1.2 \Delta_o$ (d) $-0.6 \Delta_o$ (2M)
2. The one with largest Δ_o value is
(a) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ (b) $[\text{Fe}(\text{NH}_3)_6]^{3+}$ (c) $[\text{Ru}(\text{CN})_6]^{3-}$ (d) $[\text{Ru}(\text{H}_2\text{O})_6]^{2+}$ (2M)
3. Which of the following will have a distorted octahedral structure
(a) $[\text{TiF}_6]^{2-}$ (b) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ (c) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ (d) $[\text{Co}(\text{CN})_6]^{4-}$ (2M)
4. $[\text{Co}(\text{NH}_3)_6]^{3+}$ has its d-d transition at 7533 cm^{-1} . What is its CFSE in kJ/mol ?
($1 \text{ kJ mol}^{-1} = 83.7 \text{ cm}^{-1}$) (2M)
5. Which of the following constitutes the strongest ligands
(a) C donors (b) O donors (c) N donors (d) halide donors (2M)
6. Write any one of the limitations of Valence Bond Theory. (1M)
7. The type of hybridization in $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ is _____ and hence the shape of
the molecule is _____ (2M)

(3)

8. d^2sp^3 hybridised complexes are called _____ orbital complexes. (1M)
9. Sketch the d – orbital splitting of Ni^{2+} in square planar complexes. (2M)
10. The μ_s spin only magnetic moment of the complex ion $[CoF_6]^{3-}$ is _____. (1M)
11. The magnitude of crystal field splitting Δ_t in tetrahedral complexes is less than in octahedral complexes. Write 2 reasons. (2M)
12. Which of the following cations is coloured in aqueous solution ? (1M)
(a) Cu^+ (b) Zn^{2+} (c) Ti^{4+} (d) Ni^{2+}
13. Write the IUPAC names of the following compounds (2M)
(i) $[CoONO(NH_3)]Cl_2$
(ii) $K_3[Cr(CN)_6]$

(4)

14. Give the molecular formula for the given complexes

(2M)

(i) Pentamminechlorocobalt(III) ion

(ii) Tetrakis(ethylenediamine)di- μ -hydroxodichromium(III)

15. The CFSE of $[\text{CoCl}_4]^{2-}$ complex is _____.

(2M)

16. Which of the following complex is tetrahedral

(i) $[\text{Ni}(\text{dmg})_2]$ (ii) $[\text{Co}(\text{CN})_4]^{2-}$ (iii) $[\text{FeCl}_4]^-$ (iv) $[\text{Cu}(\text{NH}_3)_4]^{2+}$

(2M)

17. Which of the following ligands does not contain donor nitrogen atom?

(1M)

(i) ammine (ii) nitrito (iii) isothiocyanato (iv) nitrosyl

18. The geometry of the complex $[\text{Ni}(\text{CO})_4]$ is _____.

(1M)
