BITS, PILANI - DUBAI
I YEAR SECOND SEMESTER,2007-2008
COMPREHENSIVE EXAMINATION (Closed book)

Course Title: Chemistry-II **Course No: CHEM UC142**
Date: 31.5.2008 **Total Marks: 120**
Time: 3 hours **Weightage: 40%**

Note: **1. Answer Part A, B, C and D separately.**
2. Answer briefly all parts sequentially
3. Useful atomic numbers: Cr(24), Mn(25), Co(27), Fe(26), Ni(28), Cu(29), Zn(30), Ti(22)
4. Question paper contains 3 pages

PART-A

1. **(i)** Predict on the basis of **CFT** whether the following complexes are square planar, tetrahedral or octahedral. Show the distribution of *d*-electrons of the central metal atom in the splitted *d*-orbitals.
(a) **$[Ni(DMG)_2]$** (b) **$[Co(NH_3)_6]^{3+}$**

(ii) Make and complete the following table for tetrahedral complexes in your answer Sheet.

Number of *d* electrons	Arrangement of electrons	Tetrahedral CFSE Δ_t	Tetrahedral CFSE in terms of Δ_o
d^3			
d^6			

[4 + 6 M]

2. **(i)** Complete the following reactions and write the name of the products

(a) 1-Hexene $\xrightarrow[THF\text{-}H_2O]{Hg(OAc)}$ $\xrightarrow[OH]{NaBH_4}$

(b) 2- Pentyne $\xrightarrow[CCl_4]{Br_2}$ $\xrightarrow[CCl_4]{Br_2}$

(c) 1-Butene $\xrightarrow{Cl_2}$ major product + minor product

(ii) Arrange the following alkenes in decreasing order of reactivity when they are subjected to acid catalyzed hydration .Give suitable reasons for the order.
$CH_2{=}CH_2$, $(CH_3)_2C{=}CH_2$, $CH_3\text{-}CH{=}CH_2$ **[6 + 4 M]**

3. **(i)** Identify the type of substitution in the reaction between *tert*-butyl bromide and water. Suggest a suitable mechanism for the same.

(ii) $CH_3CH_2CH_2CH_2CH_2CH_2Br + NaCN \rightarrow CH_3CH_2CH_2CH_2CH_2CH_2CN + NaBr$
In which solution will this reaction occur faster, DMF or ethanol? Give reasons. **[6 + 4 M]**

PART-B

1. **(i)** (a) Write the IUPAC name of the following complex
   $[Co(CO_3)(NH_3)_5]Cl$
   (b) Write the formula of the following coordination compound.
   Tris(ethylenediamine)chromium(III)chloride.
   (ii) Write the state of hybridization of the central metal atom, magnetic behavior and geometry of the given complexes using VB theory.
   $[Mn(CN)_6]^{4-}$
   $[Cu(NH_3)_4]^{2+}$

[4+6 M]

2. **(i)** Write the conditions for a compound to be aromatic.
   (ii) Classify the following compounds into Aromatic / Non aromatic / Anti aromatic and give reasons.
   (a) Cyclooctatetraene (b) Pyridine
   (c) Cyclopentadienyl cation

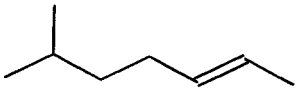
[4 + 6 M]

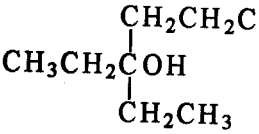
3. **(i)** Write the free radical mechanism for the fluorination of methane.
   (ii) Give the mechanism for the radical polymerization of Propene. **[5 + 5M]**

PART-C

1. **(i)** Why Metal-EDTA complexes are more stable than Metal complexes with unidentate ligand? State any three Metal-EDTA complexes and their applications.
   (ii) Which type of physical measurement is used to differentiate geometrical isomers and optical isomers? Explain how it can be useful. **[5+5 M]**

2. **(i)** Write the IUPAC names for (*a, b*) and structures for (c,*d and e*) **[10M]**

(*a*) 

(*b*) 

(*c*) (E)-2-Methyl-3-hexene (*d*) 3-Butene-2-one

(*e*) 3-Methylbutanal

3. **(i)** Give the product of dehydrohalogenation reaction of 2-bromopropane with ethoxide ion . Write the mechanism of the reaction.
   (ii) What type of substitution reaction takes place in benzene molecule? How will you synthesize chlorobenzene from benzene? Give the mechanism of the reaction. **[5 + 5 M]**

PART-D

1. **(i)** Draw the structural formula of diborane. Determine the total number of valency electrons and the number of electrons from hydrogen and boron atoms respectively.
   (ii) Name the type of bonds formed in the structure of diborane you have provided and give a concise description of the bonds. **[6 + 4 M]**

2. **(i)** Draw four structural isomers of monochloroisopentane. Place an asterisk on any chiral carbon in each structure and indicate the four different groups about the carbon by writing them below each structural formula.
   (ii) A 1.5 g sample of an enantiomer is dissolved in ethanol to make 50 cm^3 of a solution. Find the specific rotation at 20° C for the sodium light (λ = 589.3 nm, the D line), if the solution has an observed rotation of +2.79° in a 10 cm polarimeter tube. **[6 + 4 M]**

3. **(i)** Draw two large structures of cyclopropane on one structure, indicate the bond angles and bond lengths and on the other structure show orbital overlaps in cyclopropane. Draw also the Newmans projection formula of cyclopropane.
   (ii) What factor besides angle strain contributes to ring strain in cyclopropane. **[8 + 2 M]**

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BITS PILANI,DUBAI
I YEAR SECOND SEMESTER,2007-2008

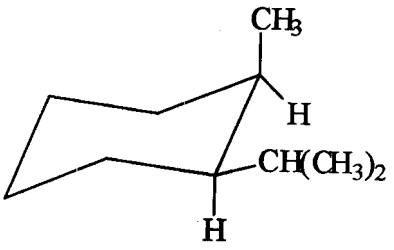
TEST- 2 (open book)

Course Title :Chemistry-II | **Course No:CHEM UC142**
Date: 1.5.2008 | **Total Marks:60**
Time: 50 min | **Weightage:20%**

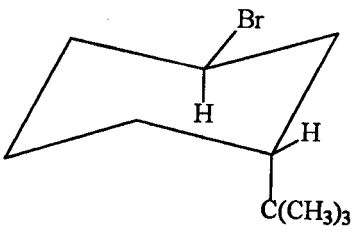
Note:1. Answer all questions
2.Useful atomic numbers: H=1,C=6,N=7,O=8,Cl=17,Br=35,I=53
2.Question paper has 2 pages

1. (i) Draw the Newmann projection for the chair conformation of **trans 1,4- diethyl cyclohexane.** Indicate which will be most stable with suitable reason.
(ii) With reference to the structures I and II indicate which is **cis** or **trans**, **more stable** or **less stable** with appropriate reasons.

[9+6M]

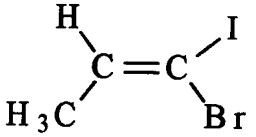


II

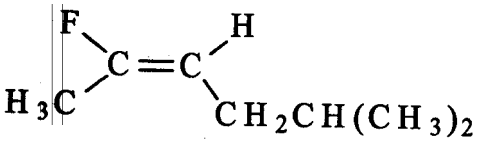


2.(i) Using **(E-Z)** nomenclature, write the **IUPAC** names of the following compounds

(a)

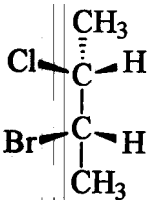


(b)

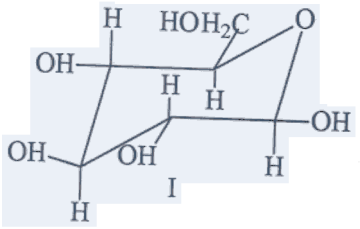


(ii) Write the most stable and the least stable conformers of $(CH_3)_2$-CH-CH-$(CH_3)_2$ Justify your answer .(Newmann projection) **[8+7M]**

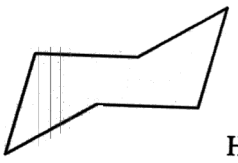
3.(i) .Identify the number of chiral centres present in the given compound.Assign **R** and **S** configuration for the same .Predict the number of possible stereoisomers and show their Fischer Projection structures for the given molecule.



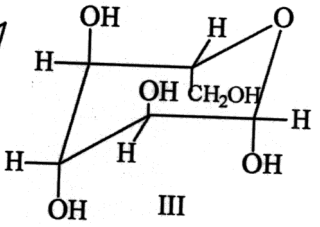
(ii). Arrange the following molecules in the **decreasing** order of their stability and give reasons. **[7+8M]**



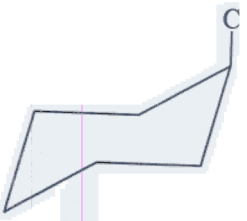
I



II



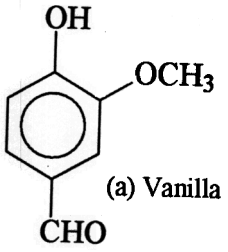
III



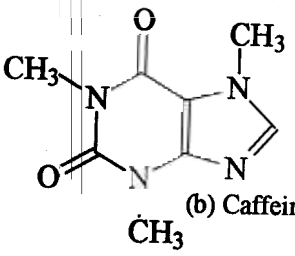
IV

4.(i) Name the following compounds with IUPAC nomenclature and appropriate classification: (a) $CH_3CH(OH)CH_3$ (b) C_7H_5N (c) $(CH_3CH_2)_3N$

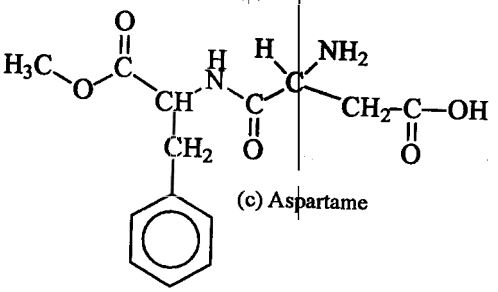
(ii) Identify at least **three functional groups** in the following compounds stating clearly the appropriate classification where possible. **[6+9M]**



(a) Vanilla



(b) Caffeine



(c) Aspartame

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BITS PILANI,INTERNATIONAL ACADEMIC CITY ,DUBAI
I YEAR SECOND SEMESTER,2007-2008

TEST- 1 (Closed book)

Course Title :Chemistry-II **Course No:CHEM UC142**
Date: 16.03.2008 **Total Marks:75**
Time: 50 min **Weightage:25%**

Note:1. Answer all questions
2. Show workings whereever necessary.
3.Useful atomic numbers:Cr(24),Mn(25),Co(27),Fe(26),Ni(28),Cu(29), Zn(30),Ti(22)
4.Question paper has 2 pages

1.(i) For each of the following species find out whether the structure is regular or distorted octahedron.Justify your answer in brief.
(a) $[TiF_6]^{2-}$ (b) $[MnF_6]^{3-}$ (c) $[Cr(ox)_3]^{3-}$
(ii) For $[Fe(H_2O)_6]^{2+}$ ion,the mean pairing energy (P) is found to be equal to 17600 cm^{-1} .The magnitude of Δ_o is 10400 cm^{-1} .Draw the CF splitting diagram for this complex ion .Calculate the CFSE for this complex ion corresponding to high spin and low spin state.Which state is more stable.why? **[9+10M]**

2.(i) Write the IUPAC names of the following complexes
$[CrCl_2(H_2O)_4]Cl$ and $[Pt\ Cl_2(NO_2)(NH_3)_2]$
(ii) Write the formula of the following complexes
(a) bis (ethylenediamine)cobalt(III)-μamido-μ-hydroxo -bis(ethylenediamine) cobalt(III) sulphate
(b)Sodium ethylenediamineacetatochromate(II)
(iii) Write the oxidation state, state of hybridization, geometry and magnetic behavior of the following complexes. (Using VB theory)
(a) $[Mn(CN)_6]^{3-}$ (b) $[Ni(CO)_4]$ **[4+5+10M]**

3. (i) Which of the following complex will be more stable ? Explain with CFSE. Show the CF splitting diagram.
(a) $[CoCl_4]^{2-}$ (b) $[CoCl_4]^{3-}$
(ii) Which of the following complex will be paramagnetic? show the splitting pattern of orbitals .Calculate the magnetic moment for the complex.
(a) $[Co(CN)_4]^{2-}$ (b) $[Ni(CN)_4]^{2-}$ (c) $[FeCl_4]^{3-}$ **[9+10M]**

4. (i) Draw two structural isomers of each of the following compounds and name the compounds.
(a) $[Co(en)_2Cl_2]^{+}$ (b) $[Cr(ox)_2(H_2O)_2]^{-}$

(ii) Give an example each for a monodentate, bidentate and a polydentate ligand clearly indicating the donor atoms .

(iii) Glycine has the structure **NH_2CH_2COOH**. It can lose a proton from the carboxyl group and form chelate rings bonded through both the nitrogen and one of the oxygen atoms. Draw structures for all possible isomers of is bis(glycinato)copper(II). **[8+6+4M]**

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