

BITS, PILANI - DUBAI

I YEAR SECOND SEMESTER, 2010-2011

COMPREHENSIVE EXAMINATION (Closed book)

Course Title: Chemistry-II

Course No: CHEM C142

Date: 29.5.2011

Total Marks: 120

Time: 3 hours

Weightage: 40%

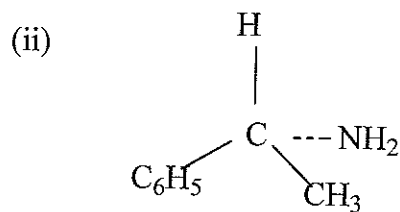
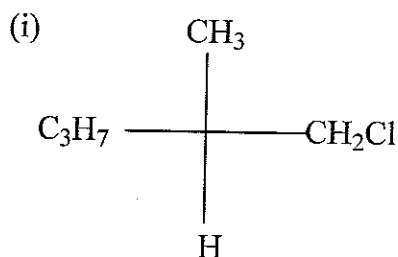
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- Note:**
1. Answer Part A, B and C separately.
 2. Answer briefly all parts SEQUENTIALLY
 3. Useful atomic numbers: C(6), N(7), Cl(17), Cr(24), Fe(26), Co(27), Ni(28), Cu(29) Br(35) , I(53)
 4. Question paper contains 3 pages
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PART -A

1. (a) Draw the crystal field splitting of a d^7 orbital in a strong and weak octahedral field. (6 M)
- (b) Explain the formation of a square planar complex of Ni^{2+} using valence bond theory. Also predict its magnetic behavior. (6 M)
2. (a) Calculate the CFSE for tetrahedral $[FeCl_4]^{-1}$ complex (4 M)
- (b) Write the IUPAC name of the following complexes. (4 M)
 - (i) $[Ni(NCS)_4]^{2-}$
 - (ii) $Na_2[Zn(CN)_4]$
- (c) Draw the structure of tetraborane. Write the number of each type of bonds and balance the total number of electrons. (4 M)
3. (a) Predict and justify, whether the following complexes have regular/distorted octahedral geometry. (10 M)
 - (i) $[Cr(H_2O)_6]^{3+}$
 - (ii) $[Cu(NH_3)_6]^{2+}$
- (b) Calculate the spin only magnetic moment of $[CoCl_4]^{2-}$. (4 M)
4. (a) Draw the geometrical isomers of dibromobis(oxalato)cobaltate(III) and comment on their optical activity with suitable justification. (6 M)
- (b) The metallic radius of Al is 1.43 \AA while that of Ga is 1.225 \AA , Explain (2 M)
- (c) Write the structure of EDTA indicating the donor atoms. (2M)

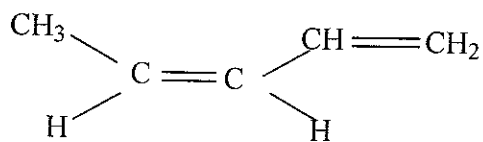
PART-B

1. (a) Designate as R or S configuration clearly indicating the priorities of the substituents. (6M)

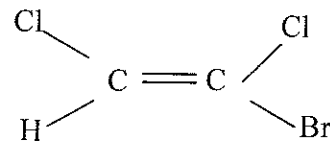


- (b) The concentration of Cholesterol dissolved in chloroform is 5.15 g per 100 ml of solution. A portion of this solution in a 6 cm polarimeter tube gives an observed rotation of -1.3° . Calculate the specific rotation of Cholesterol. (2M)
- (c) Write structural formulae for the following compounds. (6M)
- (i) 1-chloro-2,2-dimethylpropane
 - (ii) 2-bromo-3-ethylbutane
 - (iii) 1-ethyl-3-methylcyclohexane
2. (a) Write the mechanism for the formation of bromobenzene from benzene. (6M)
- (b) Name the following compounds with E-Z nomenclature. (4M)

(i)

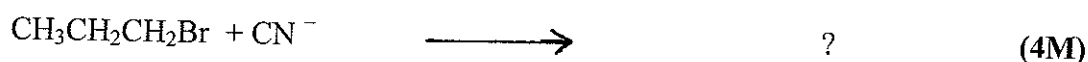


(ii)

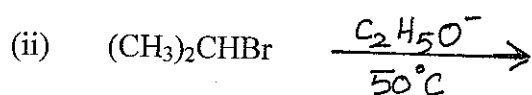
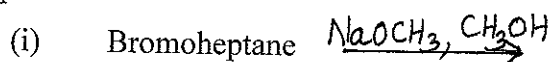


PART-C

1. (a) Draw the Newmann projections for the staggered conformations of 2-bromobutane, viewing through the C2-C3 bond. Indicate which will be the least stable. (4M)
- (b) Draw the two possible chair conformations of t-butyl cyclohexane. Name the type of strain in these conformations. (4M)
- (c) Write the kinetics and mechanism of the substitution reaction given below



2. (a) Write the major and minor elimination products obtained when 2-bromo-2,3-dimethylbutane reacts with KOH in the presence of alcohol. (2 M)
- (b) In a protic solvent fluoride ion is not an effective nucleophile as the other halide ions. Why? (2M)
- (c) Give the products that you would expect to be formed in each of the following reactions. Predict the mechanism (S_N^1 , S_N^2 , E1 and E2), major and minor product. (8M)



3. (a) Write the product of ozonolysis of 2,4-dimethylpent-2-ene showing the reaction mechanism. (4M)
- (b) Write the product of the bromination of acetylenedicarboxylic acid. (4M)
- (c) Write the free radical reaction mechanism for the formation of polytetrafluoroethene. (8M)
4. (a) Using Huckel's rule identify the following compounds (as aromatic/non aromatic/homoaromatic/antiaromatic). (4M)
- (i) Biphenyl (ii) Cycloheptatrienyl cation
- (b) Pyrrole is a weaker base while pyridine is a strong base-Why? (4M)

**BITS, PILANI – DUBAI CAMPUS,
DUBAI INTERNATIONAL ACADEMIC CITY**

FIRST YEAR – SECOND SEMESTER (2010-2011), TEST-2 (Open Book)

Course Title : CHEMISTRY II

Course No: CHEM C142

Date : 15.05.2011

Maximum Marks : 60

Time : 50 min

Weightage : 20%

1. a) Which one of the following compound under goes S_N2 reaction at a faster rate? Justify the result with respect to the nature of the substrate.

2-bromopropane

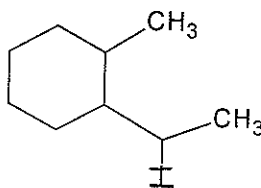
2-bromo-2-methylpropane

- b) Arrange the following nucleophiles in the order of their increasing nucleophilicity.

NH_3 , PH_3 , AsH_3 .

- c) When iodomethane and 2-iodo-2-methylpropane subjected to S_N1 reaction, which one's rate would be faster. Justify the result. (4+4+4)

2. a) The following compound undergoes elimination reaction when heated with sodium methoxide in methanol. Predict (i) Major and Minor elimination products
(ii) Molecularity of the reaction.



- b) Give the products formed during the solvolysis (substitution) of (R)-3-bromo-3-methyl heptane in methanol. Indicate which product is formed in larger proportion and the molecularity of the reaction. (4+8)

3. a) Write the mechanism for addition of HBr on 2-methylbut-1-ene.
 b) Show the reaction mechanism for the hydration of 3,3-dimethylbut-1-ene.
 c) Write the mechanism for the conversion of 2-methylbut-2-ene into 2-methylbutan-2-ol through oxymercuration reaction. (4+4+4)

4. How will you prepare the following compounds by addition reactions? Write the appropriate chemical equations.

a) i) 1,1,2,2-tetrachloroethane.

ii) Acetaldehyde.

iii) 2-methyl-3,4-hexanedione.

b) 1-heptyne + HI \rightarrow ? (3+3+3+3)

5. Give the products that you would expect to be formed in each of the following reactions. Predict the mechanism (S_N1 , S_N2 , E1 and E2), major and minor product. (5+5+2)

a) 3-chloropentane + ethoxide ion \longrightarrow

b) $(CH_2CH_3)_3CCl \xrightarrow[CH_3OH]{50^\circ C}$

c) 2-bromobutane + NaI $\xrightarrow[CH_3OH]{25^\circ C}$

BITS, PILANI – DUBAI CAMPUS,
DUBAI INTERNATIONAL ACADEMIC CITY

FIRST YEAR – SECOND SEMESTER (2010-2011), TEST-1 (Closed Book)

Course Title : CHEMISTRY II

Date : 27.3.11

Time : 50 min

Course No: CHEM C142

Maximum Marks : 75

Weightage : 25%

Atomic numbers: H=1, O=8, C=6, N=7, S=16, Cl=17, I=53, Cr=24, Ni=28

1. Write the formula of the following compounds.

(3+3)

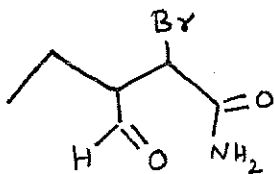
a) 1,2,5-pentanetricarbaldehyde

b) Trimethylammonium iodide

Write the IUPAC name of the compounds.

(3+3+3)

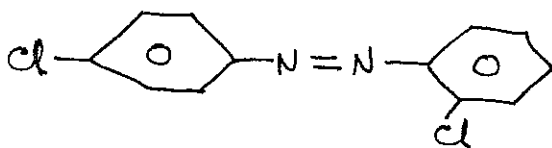
c)



d)

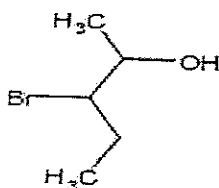


e)



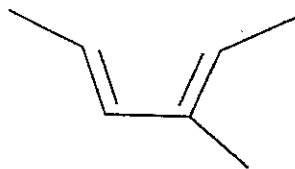
2. a) Identify the chiral center(s) by marking * in the compound.

(2)



b) Give the IUPAC name (with E-Z notation) of the compound.

(5)

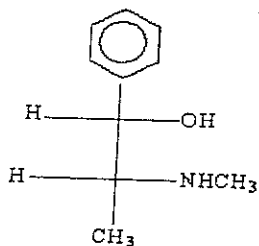


c). Draw all possible stereo isomers of 2,3-dichlorobutane and comment on their optical activity.

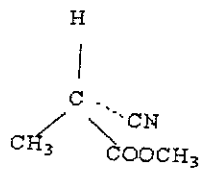
(8)

3. a) The ionic radii for M^{3+} increases down the group-13 though not in a regular way - give reason.
- b) The +3 oxidation state becomes less stable in aqueous solutions on descending group-13 – justify on the basis of standard reduction potential.
- c) Draw the structure of tetraborane (B_4H_{10}). Show the number, nature and types of bonds with the number of valence electrons involved. (3+3+9)
4. i) Draw the CF splitting diagram indicating the number of electrons in each level and predict the shape of the following complexes.
- a) $[Ni(CN)_4]^{2-}$ b) $[Cr(oxalate)_3]^{3-}$
- ii) Why thallos compounds are more stable than thallic compounds? (6+6+3)
5. i). Assign R / S designation for the following compounds clearly indicating the priorities of the groups. (3+3+3)

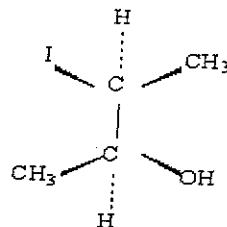
(e)



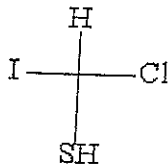
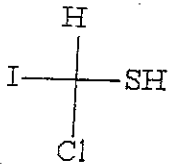
(b)



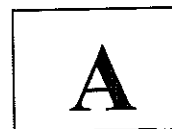
(c)



- (ii) Consider the following pair of structures and write whether they represent the enantiomers or molecules of the same compound with different orientations. (3)



- (iii) Write the structure of a meso alkane having the molecular formula C_8H_{18} and name the compound. (3)



BITS, PILANI – DUBAI
SECOND SEMESTER 2010 – 2011
FIRST YEAR Quiz-2

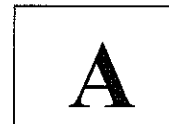
Course Code: CHEM C142
Course Title: Chemistry II
Duration: 20 minutes

Date: 18.04.2011
Max Marks: 21
Weightage: 7 %

Name: ID No: Sec.....

1. Calculate the specific rotation, if 0.75 g of an optically active compound dissolved in 15 ml of water in a 100 mm cell gave a rotation of $+3.75^\circ$. (2 M)
2. Write the IUPAC notation used to distinguish enantiomers. (2 M)
3. Draw the two chair conformations of cis-1-cyano-4-isopropyl cyclohexane. Indicate which is most stable? (3 M)
4. Draw the most stable conformation of 1-bromo-1-ethylcyclohexane using Newmann projection formula. (2 M)

5. 1,3-dichloroallene does not contain an asymmetric carbon atom, but it is chiral. Justify. (2M)
6. Classify the following molecules as chiral or achiral.
(i) 2,3-pentadiene. (ii) 2-methylbutane (2 M)
7. Mention any two reasons for a weaker C-C bond in cyclopropane. (2 M)
8. Arrange the conformers of cyclohexane (twist boat, chair, half chair & boat) in the order of increasing energy. (2 M)
9. Draw the Newmann projection of 2-methyl propane and show the potential energy diagram of the different conformers (eclipsed and staggered) as it rotates about C_1-C_2 . (2+2 M)
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BITS, PILANI – DUBAI
SECOND SEMESTER 2010 – 2011
FIRST YEAR Quiz-1

Course Code: CHEM C142
Course Title: Chemistry II
Duration: 20 minutes

Date: 28.02.2011
Max Marks: 24
Weightage: 8 %

Name: ID No: Sec.....

Instructions: Atomic Numbers: Mn=25, Fe=26, Co=27, Ni=28, Cu=29, Zn=30, Ir=77

1. Write the formula of μ -Hydroxobis[pentaamminechromium(III)] bromide. (2.5 M)
2. Write the IUPAC name of $K[PtCl_3NH_3]$. (2.5 M)
3. Calculate the CFSE for a high-spin octahedral complex of a d^6 ion. (2.5 M)
4. Pick out the species having greater Δ_o from the following and give reason for your choice.
(a) $[Co(NH_3)_6]^{3+}$ (b) $[Ir(NH_3)_6]^{3+}$ (2.5 M)
5. Calculate the tetrahedral CFSE of $[NiCl_4]^{2-}$ by showing the arrangement of electrons in its e_g and t_{2g} orbitals. (2.5 M)

6. Octahedral complexes are more stable than that of tetrahedral complexes. Justify. (2.5 M)
7. $[\text{CoCl}_4]^{2-}$ is paramagnetic with 3 unpaired electrons, predict the hybridization and the structure using VBT. (3 M)
8. $[\text{Co}(\text{NH}_3)_6]^{3+}$, if it is an inner orbital complex comment on its magnetic property using VBT.(2 M)
9. Calculate the magnetic moment for the Mn(III) complex in an weak octahedral field. (2 M)
10. What are the metals present in chlorophyll and vitamin B₁₂. (2 M)
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