

P.G. 1st Semester - 2016**CHEMISTRY**

(CBCS)

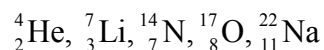
Paper : MCHECCT101

Full Marks : 40

Time : 2 Hours

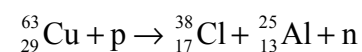
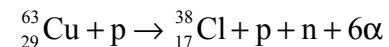
*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.*Answer any **five** taking at least **two** from each Group.**GROUP-A**

1. a) Define nuclear magic number. What are those numbers? Define 'magic nuclei' and 'doubly magic nuclei'.
b) Atomic numbers of K, Ca, and Sc are 19, 20 and 21, respectively. Which element has highest number of isotopes? Give reason.
2. a) Find the spin and parity of the nuclei :



$$4+4=8$$

- b) State the difference between spallation and fission. Identify them from the below :



$$5+3=8$$

3. a) Find the "nuclear binding energy" (ΔE) of helium nucleus if the mass of a proton, a neutron and that of a helium nucleus are 1.008, 1.009 and 4.0039 respectively.
b) Using the mass parabola, explain why uranium emits α particles and not individual protons and neutrons.
c) Explain the significance of the surface energy term " $a_5 A^{2/3}$ " appearing in the semi empirical binding energy equation of the liquid drop model of the nucleus. $3+3+2=8$
4. a) Discuss the conditions of transient equilibrium of radioactive decay using a suitable graph.
b) Calculate the activity in dps and Ci (disintegrations per second and curie) expected for a 1.00mg ${}^{252}\text{Cf}$ source that is 10.0 years old. The half life of ${}^{252}\text{Cf}$ is 2.64y.
c) Describe the process of compound nucleus formation during a nuclear reaction.

- d) Reactions with thermal and cold neutrons generally result in radiative capture rather than particle emission. Explain. $2+2+2+2=8$

GROUP-B

5. a) A chemist analyzes a sample of iron ore (furnished by NIST) and obtained the following results:

$$\bar{x} = 10.52, S = 0.02, n = 10.$$

The NIST value for this sample is 10.60% Fe. Are the results significantly different at the 95% probability level?

(Given: at degree of freedom = 9 and 95% probability level, $t=2.262$)

- b) What is the utility of Q-test?
c) What is correlation coefficient? Give the significance. $4+2+2=8$
6. a) Discuss SO_2 pollution on plants.
b) Write short note on carcinogenic effect of DDT.
c) What is acid rain? $3+3+2=8$

7. a) Write short note on metal ion toxicity.
b) Give some physical characteristics of photochemical smog.
c) Give the synthetic pathway for the formation of polycyclic aromatic hydrocarbon epoxide.

$$3+3+2=8$$

8. a) What is quality control chart?
b) Discuss about paired t-test.
c) Define the terms: BOD and COD.

$$3+3+2=8$$

P.G. 1st Semester - 2016

CHEMISTRY

(CBCS)

Paper : MCHECCT103

Full Marks : 40

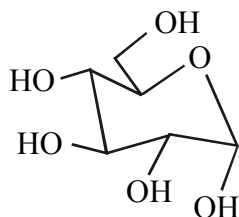
Time : 2 Hours

*The figures in the right-hand margin indicate marks.
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own words as far as practicable.*

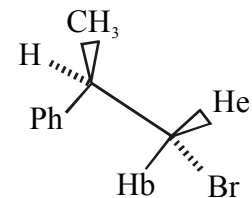
Answer any **five** taking at least **two** from each Group.

GROUP-A

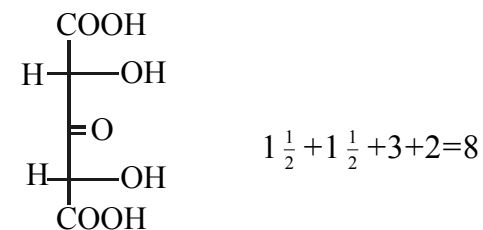
1. a) Find out the element of symmetry of the following compound & determine the general point group.



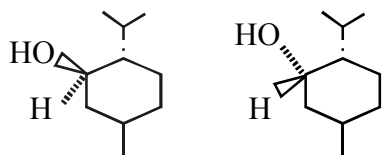
- b) Identify the pro-R/pro-S hydrogen atoms (marked) of the following molecule.



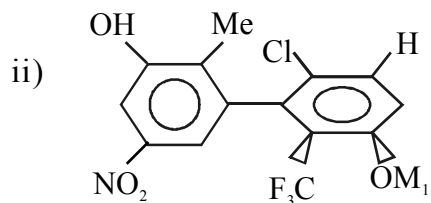
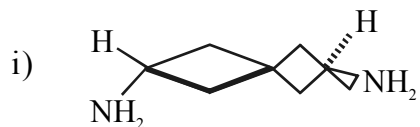
- c) Draw the Felkin-Anh & Cram models for (S)-benzoin and show the reaction with CH_3MgI .
- d) Comment on the nature of stereoheterotopic faces of the $>\text{C}=\text{O}$ group of the compound given below:



2. a) Which one of the structures given below represents the configuration of the (-)-menthol if its ester with Ph CO COOH given (R)-atrolactic acid as the predominant compound when reacted with MeMgX followed by hydrolysis? Give the mechanisms of the reaction.



- b) Find out the absolute configuration of the following axially chiral compounds.

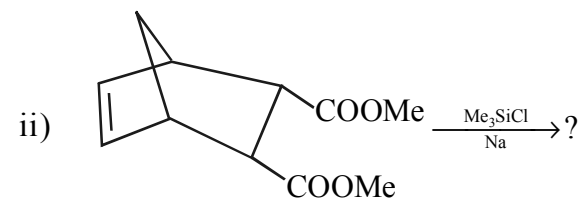
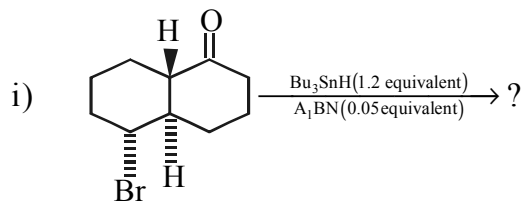


- c) Explain the following observation:

"Syn(z) diastereomers of 2-Methyl cyclohexylidene acetic acid exist mainly with Methyl group axial position."

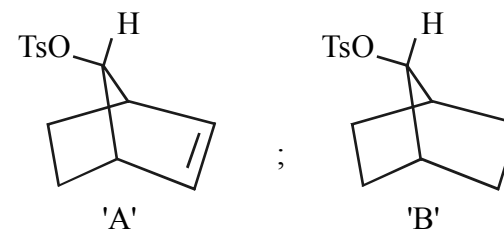
$$3+3+2=8$$

3. a) Give product(s) with mechanism:

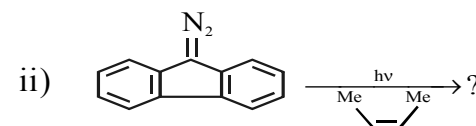
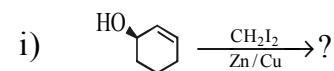


- b) Explain how electron donating group and electron withdrawing group both give stability to a radical. 5+3=8

4. a) Acetolysis of compound 'A' is 10^{11} times faster than that of compound B. Why?



- b) Give product(s) with mechanism indicating the major product for the following reaction:



$$3+5=8$$

GROUP-B

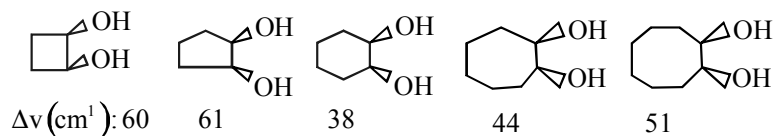
5. a) The following compound exhibit two absorption bands due to a specific bond as indicated. Explain the observations.

i) $\text{RCOOCOR} : \nu_{\text{C=O}}$ at 1750 & 1820 cm^{-1}

ii) 2-tert-butylphenol :

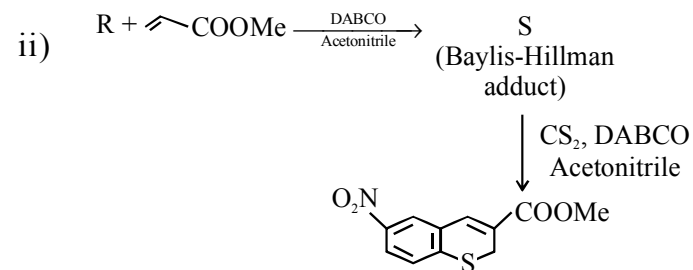
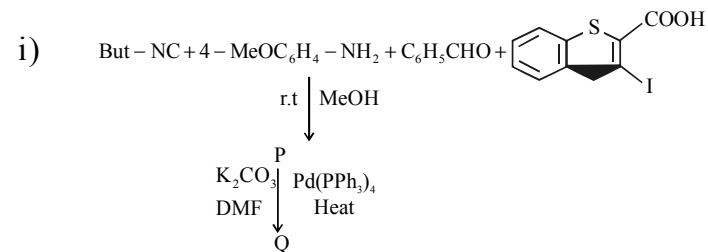
$\nu_{\text{O-H}}$ at 3640 (sh) & 250 (br) cm^{-1}

b) The following cis-1, 2-diols show frequency reduction ($\Delta\nu = \nu_{\text{O-H, free}} - \nu_{\text{O-H, bonded}}$) in the H-bonded O-H bond stretching position by an amount as given. Rationalize the observations.

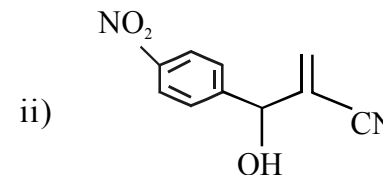
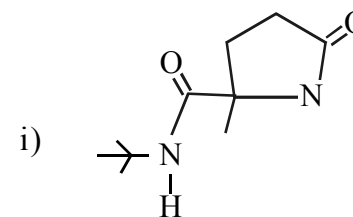


c) The O-H absorption peak appears at 300 cm^{-1} . What happens in the IR spectrum when H of O-H is replaced by D? Explain your answer. $3+3+2=8$

6. a) Draw the structure of the compounds, (P)–(S), in the following transformations.

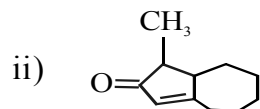
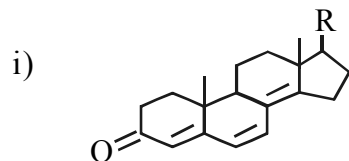


b) Synthesize the following compounds in single step using appropriate reactants and catalysts, if necessary

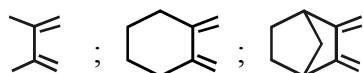


c) What do you mean by multicomponent reactions? $4+3+1=8$

7. a) Predict the λ_{\max} values for the following compounds according to Woodward Fieser rule:



b) Compare the absorption maxima in UV spectroscopy for the following compounds:



c) When aniline is dissolved in chloroform and tetracyanoethylene is added to it, a deep blue solution results. Account for the observation.

d) What is optical bleach? $3+1\frac{1}{2}+2+1\frac{1}{2}=8$

8. a) Explain why the methyl groups in 15, 16-Dihydro-15, 16-dimethylpyrene are observed at -4.2ppm in the $^1\text{H-NMR}$ spectrum.

b) Predict the spin multiplicity and approximate chemical shift values for the different types of hydrogen present in 1,1,2-Trichloroethane.

c) A compound with molecular formula $\text{C}_6\text{H}_{12}\text{O}_2$ shows four signals:

δ 1.1; 6H : S δ 2.6; 2H, S
 δ 2.1; 3H : S δ 3.9; 1H, S

Propose a structure consistent with the given data.

d) Sketch the proton NMR spectrum showing relative chemical shifts and splitting pattern for vinyl acetate. Explain clearly the AMX coupling of vinyl protons. $1\frac{1}{2}+1\frac{1}{2}+2+3=8$

P.G. 1st Semester - 2016

CHEMISTRY

[Old Syllabus]

Paper : CH-103

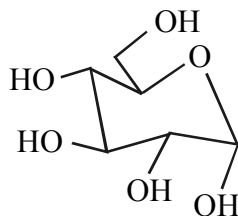
Full Marks : 45

Time : 2 Hours

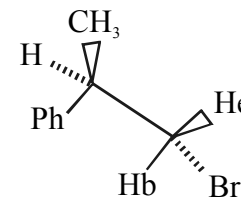
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GROUP-A

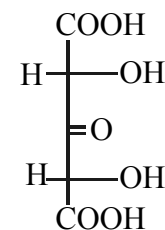
1. a) Find out the element of symmetry of the following compound & determine the general point group.



- b) Identify the pro-R/pro-S hydrogen atoms (marked) of the following molecule:

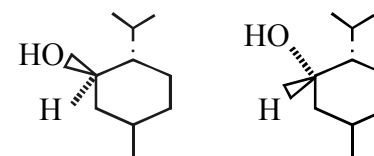


- c) Draw the Felkin-Anh & Cram models for (S)-benzoin and show the reaction with CH_3MgI .
- d) Comment on the nature of stereoheterotopic faces of the $>\text{C}=\text{O}$ group of the compound given below:



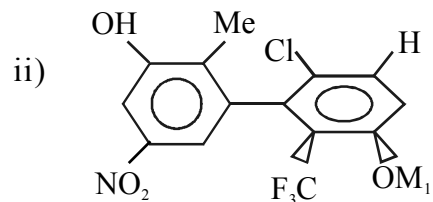
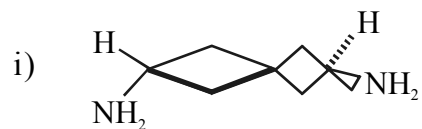
2+2+3+2=9

2. a) Which one of the structures given below represents the configuration of the (-) menthol if its ester with Ph CO COOH gives (R)-atrolactic acid as the predominant compound when reacted with MeMgX followed by hydrolysis? Give the mechanisms of the reaction.



[Turn Over]

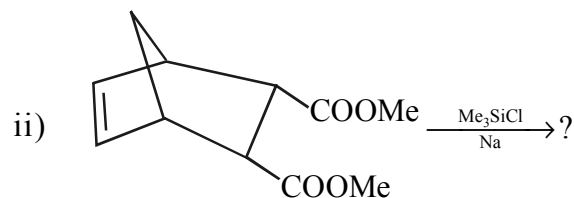
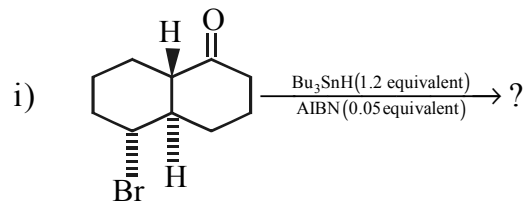
- b) Find out the absolute configuration of the following axially chiral compounds.



- c) Explain the following observation:
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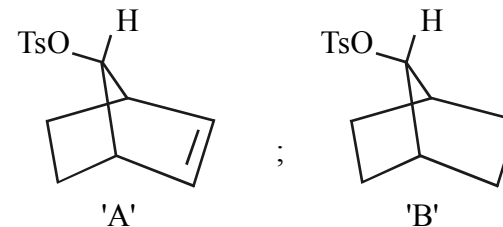
4+3+2=9

3. a) Give product(s) with mechanism:

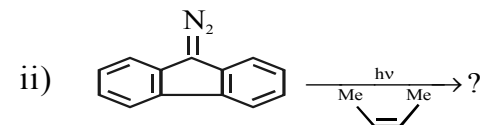
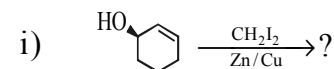


- b) Explain how electron donating group and electron withdrawing group both give stability to a radical. 6+3=9

4. a) Acetolysis of compound 'A' is 10^{11} times faster than that of compound B. Why?



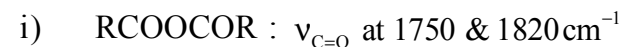
- b) Give product(s) with mechanism indicating the major product for the following reaction:



3+6=9

GROUP-B

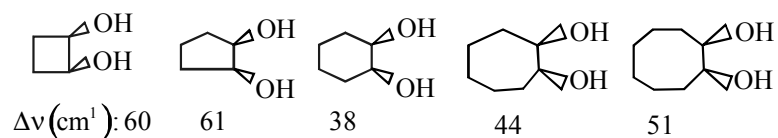
5. a) The following compound exhibit two absorption bands due to a specific bond as indicated. Explain the observations.



ii) 2-tert-butylphenol :

$\nu_{\text{O-H}}$ at 3640 (sh) & 2500(br) cm^{-1}

b) The following cis-1, 2-diols show frequency reduction ($\Delta\nu = \nu_{\text{O-H, free}} - \nu_{\text{O-H, bonded}}$) in the H-bonded O-H bond stretching position by an amount as given. Rationalize the observations.



c) The O-H absorption peak appears at 3600cm^{-1} . What happens in the IR spectrum when H of O-H is replaced by D? Explain your answer. $3+3+3=9$

6. a) Define the following term:

- Auxochrome
- Bathochroic shift
- Finger print region
- Chemical shift

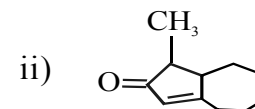
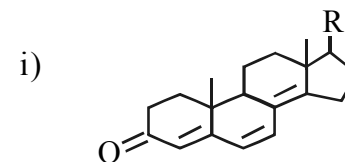
b) How do you distinguish the following compounds by using any spectroscopic method in your choice?

i) Cis & trans stilbene

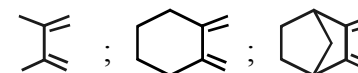
ii) Ethyl acetate & Methyl propanoate

$$(4 \times 1 \frac{1}{2}) + (2 \times 1 \frac{1}{2}) = 9$$

7. a) Predict the λ_{max} values for the following compounds according to Woodward Fieser rule:



b) Compare the absorption maxima in UV spectroscopy for the following compounds:



c) When aniline is dissolved in chloroform and tetracyanoethylene is added to it, a deep blue solution results. Account for the observation.

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