

Uva Wellassa University, Sri Lanka
End Semester Examination – March 2012
SCT 332 – 3 Materials Chemistry II
Time: Three (03) hours



This paper consist of two parts: Part – A and Part – B.

Total Six (06) questions

Question 01, 05 and 06 are compulsory

Answer 03 questions from Part-A including question 01 and answer all questions in Part -B

PART – A

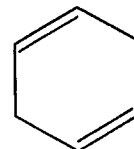
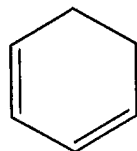
01) Consider the molecules given below.

i. Eclipsed ethane conformer

ii. Staggered ethane conformer

iii. 1, 3-cyclohexadiene

iv. 1,4-cyclohexadiene



v. H_2O

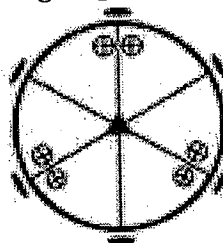
- a. List all the symmetry elements in each molecule; hence deduce the point group to which each molecule belongs.
- b. Draw the stereographic projections of two of the point groups you predict for the above molecules.

(100 marks)

02. a. i. Define “Abelian group”.

ii. By constructing a group multiplication table, prove that the collection of symmetry elements of C_{2h} point group forms an Abelian group.

b. The stereographic projection of a point group is given bellow.



- i. Deduce the symmetry elements in this group.
- ii. State the point group to which this stereographic projection belongs to.
- iii. Sketch a shape of a possible molecule belongs to this point group.

(50 marks)

- 03) a. *Muscovite* and *biotite mica* are in the same silicate mineral group due to their extreme similarity. State the only significant difference between *Muscovite* and *biotite mica*.
- b. Explain the reason for the variation of Si:O ratio in different silicate minerals
- c. Name the two groups of silicates which the *asbestos* mineral are belong to.
- d. Draw the general structure of one of the groups you mention in (c) above.
- e. Though *asbestos* is chemically inert, it presents a series of health hazard. Name one of them.

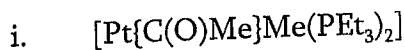
f. i. According to the structure of borane they can be classified into four groups. Name three of them.

ii. Draw the structure of the following boranes.

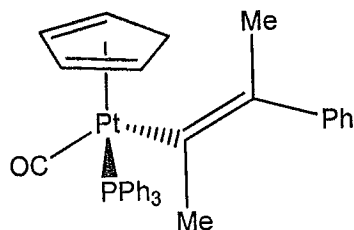


(50 marks)

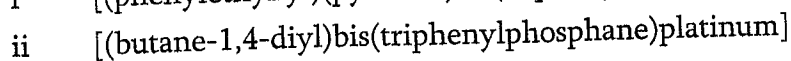
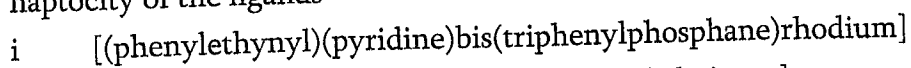
04) a. Write the IUPAC name of the following organometallic compounds.



ii.



b. Draw the structure of the following organometallic compounds and determine the hapticity of the ligands



c. Carbon monoxide has a triple bond. Draw an orbital diagram to represent the bonding in CO.

d. Account for the variation in C=C stretching frequencies in the following compounds

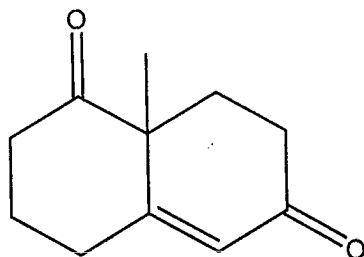
Compound	$\nu(C=C)$ in cm^{-1}
Free $CH_2=CH_2$	1623
$[Ag(\eta^2-CH_2=CH_2)_2]BF_4$	1584
$[CpRh(\eta^2-CH_2=CH_2)_2]$	1493

(50 marks)

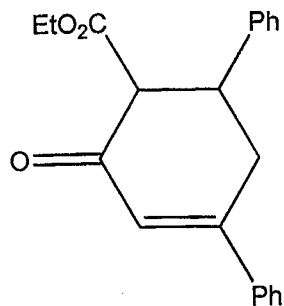
PART - B

05) By applying retrosynthetic analysis, give a reasonable synthetic route for any four of the following molecules. Clearly indicate retrosynthetic analysis and synthetic routes.

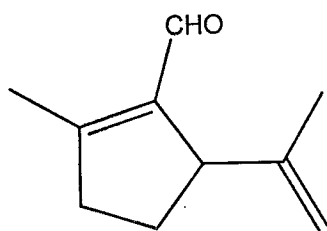
a.



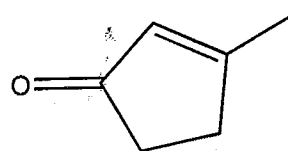
b.



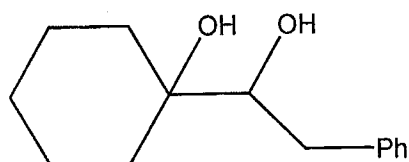
c.



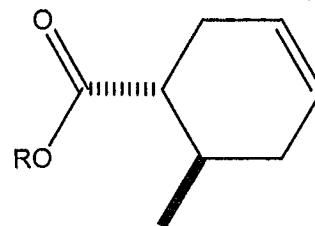
d.



e.



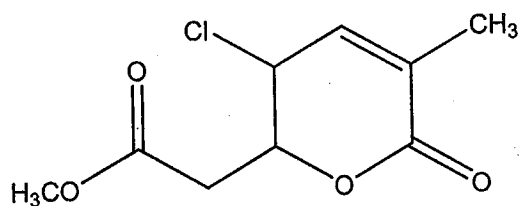
f.



(50 marks)



- 06) Some of the data obtained from NMR spectrums of *compound A* ($C_9H_{11}O_4Cl$) are given bellow. Assign all the 1H -NMR signals and ^{13}C -NMR signals.



Compound A

1H -NMR spectrum – six signals

δ / ppm	No of H responsible	Multiplicity
2.43	3H	doublet
2.55	2H	doublet
3.70	3H	singlet
4.74	1H	doublet of a doublet
4.94	1H	doublet of a triplet
6.51	1H	doublet of a quarted

^{13}C -NMR spectrum- nine signals

18.3, 33.1, 51.9, 58.1, 78.1, 128.2, 137.6, 166.4 and 171.5

DEPT

Signal at δ 33.1 was due to CH_2 carbon atoms

Signal at 128.2, 166.4 and 171.5 were due to quaternary carbon atoms

COSY

Correlations between 1H -NMR signal at 4.74 and 4.94.

HMOC correlations

1H -NMR signal	^{13}C -NMR signal
4.74	58.1
4.94	78.1
6.51	137.6

HMBC 2-and 3-bond correlation

^{13}C -NMR signal	1H -NMR signal
78.1	2.55, 4.74 and 6.51
128.2	2.43, 4.74 and 6.51
166.4	2.43 and 6.51

(50 marks)