

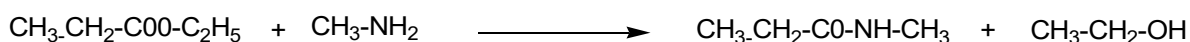
**Shivaji University, Kolhapur**  
**Question Bank For Mar 2022 ( Summer ) Examination**

Subject Code : 81564

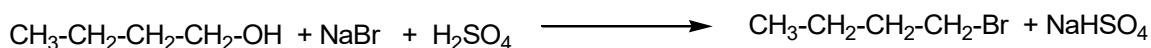
Subject Name : M.SC. Part No - 2(Sem-4) CBCS - Theoretical Organic Chemistry

**Short questions (For one mark each):**

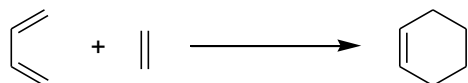
1. Who coined the term Green Chemistry?
2. Total number of green chemistry principles are \_\_\_\_\_.
3. What is the main purpose of green chemistry principles?
4. Write the names of any two renewable feedstocks.
5. What are renewable feedstocks?
6. What are disadvantages of non-renewable feedstocks?
7. Find out the atom economy of the following reaction used for the preparation of N-methyl propionamide?



8. Find out the atom economy of the following reaction used for the preparation of butyl bromide?



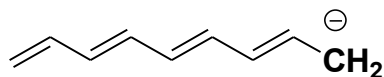
9. Find out the atom economy of the following Diels-Alder reaction used for the preparation of cyclohexene?



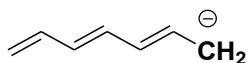
10. What are ionic liquids?
11. Mention the names of any two ionic liquids?
12. Mention any two advantages of heterogeneous catalysts?
13. Which green chemistry principle suggests the use of microwaves in chemical reactions?
14. What is frequency at which domestic microwave oven works?
15. Which principle suggests to avoid protection/deprotection in organic synthesis?
16. Which biopolymers are used in biodegradable plastic bags?

17. What are supercritical solvents?
18. How ultrasound assists organic reactions?
19. According to the green chemistry principles, chemicals used in the synthesis should be \_\_\_\_\_.
20. Which term is used to measure an environmental impact of a product or a person?
21. What is kinetically controlled reaction?
22. What is thermodynamically controlled reaction?
23. State True or False:  
Thermodynamically controlled reactions offer more stable product due to reversibility.
24. What do you mean by stabilized ylide?
25. What do you mean by non-stabilized ylide?
26. Cite an example of stabilized ylide.
27. Cite an example of non-stabilized ylide.
28. Complete the following statement.  
 $\text{Ph}_3\text{P}=\text{CHCO}_2\text{Et}$  is \_\_\_\_\_ ylide.
29. Which product predominates on sulphonation of naphthalene at  $160^\circ\text{C}$ ?
30. Which product predominates on sulphonation of naphthalene at  $80^\circ\text{C}$ ?
31. Which product predominates when cyclopentadiene reacts with maleic anhydride at room temperature?
32. Which product predominates when cyclopentadiene reacts with maleic anhydride at high temperature?
33. Which product predominates when benzaldehyde reacts with  $\text{Ph}_3\text{P}=\text{CHCO}_2\text{Me}$  in Wittig reaction?
34. Which product predominates when benzaldehyde reacts with  $\text{Ph}_3\text{P}=\text{CHMe}$  in Wittig reaction?
35. Mention any one factor that favours kinetic enolate.
36. Mention any one factor that favours thermodynamic enolate.
37. What is non-classical carbocation?
38. What type of bonding is present in non-classical carbocation?
39. Write the structure of the intermediate involved in acetolysis of anti-7-norborneyl tosylate?
40. Write the structure of the intermediate involved in acetolysis of endo-2-norbornyl brosylate?
41. How many bonding molecular orbitals, non-bonding molecular orbitals and antibonding molecular orbitals are present in cyclobutadiene?
42. How many bonding molecular orbitals, non-bonding molecular orbitals and antibonding molecular orbitals are present in cyclopentadiene?
43. How many bonding molecular orbitals, non-bonding molecular orbitals and antibonding molecular orbitals are present in cycloheptatriene?
44. How many bonding molecular orbitals, non-bonding molecular orbitals and antibonding molecular orbitals are present in cyclooctatetraene?
45. Comment on aromaticity of cyclopentadienyl anion.
46. Comment on aromaticity of cycloheptatrienyl anion.
47. Comment on aromaticity of tropylium cation.

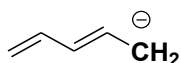
48. Define alternant hydrocarbon.
49. Define non-alternant hydrocarbon.
50. Write the structures of any two alternant hydrocarbons.
51. Write the structures of any two non-alternant hydrocarbons.
52. Calculate the charge density in the following.



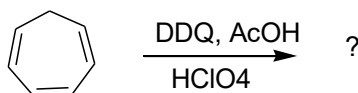
53. What is delocalization energy of cyclooctatetraenide dication?
54. What is delocalization energy of cyclooctatetraenide dianion?
55. What is delocalization energy of cyclopentadienyl cation?
56. Calculate the charge density in the following.



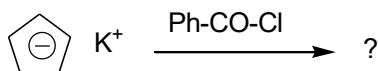
57. Calculate the charge density in the following.



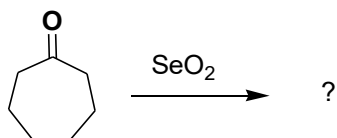
58. Define Huckels rule of aromaticity?
59. What is PMO theory?
60. Which formula is used to calculate the energy of orbitals in acyclic systems?
61. What are fullerenes?
62. Explain why cyclobutadiene is unstable?
63. Enlist various types of cyclodextrins.
64. Write the structure of 18-crown-6. How many signals will it give in PNMR spectrum?
65. How will you prepare potassium salt of cyclopentadienyl anion?
66. What are fulvenes?
67. What are crown ethers? Who discovered them?
68. Why tropolone is regarded as extended acid?
69. What are fullerenes?
70. Enlist various types of cyclodextrins.
71. Write the product of following reaction.



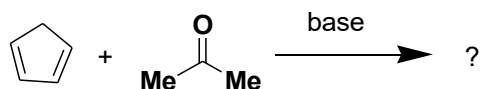
72. Write the product of following reaction.



73. Write the product of following reaction.



74. Write the product of following reaction.



75. Write the product of following reaction.



76. Write the product of following reaction.



77. Define catenanes.

78. What are rotaxanes?

79. How is ferrocene prepared?

80. State true or false: Azulene undergoes electrophilic as well as nucleophilic substitution reactions.

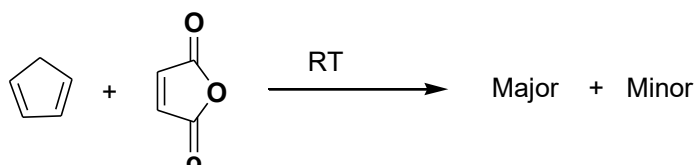
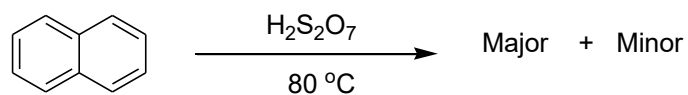
**Questions for 10, 8 and 6 marks.**

1. Give an account on principle of green chemistry with suitable examples.
2. What is green chemistry? Explain twelve principles of green chemistry citing appropriate examples.
3. Explain the following principles of green chemistry giving examples.
  - i) Prevention
  - ii) Atom economy
4. Explain the following principles of green chemistry giving examples.
  - i) Less Hazardous Chemical Syntheses
  - ii) Safer Solvents and Auxiliaries
5. Explain the following principles of green chemistry giving examples.
  - i) Design for Energy Efficiency
  - ii) Reduce Derivatives
6. Explain the following principles of green chemistry giving examples.
  - i) Catalysis
  - ii) Design for degradation
7. Explain the following principles of green chemistry giving examples.
  - i) Real-time analysis for Pollution Prevention
  - ii) Inherently Safer Chemistry for Accident Prevention
8. Describe various strategies used in green synthesis.
9. What are ionic liquids? How are they prepared? Explain their properties and significance in organic synthesis.
10. Explain microwave chemistry in details.
11. What are supercritical solvents? Explain their applications.
12. Explain the applications of ultrasound in organic synthesis.
13. Explain various strategies used in environmentally benign synthesis.
14. Describe kinetic and thermodynamic control in sulphonation of naphthalene.
15. Describe kinetic and thermodynamic control in Diels-Alder reaction.
16. Describe kinetic and thermodynamic control in Friedel-Crafts benzylation of toluene.
17. Describe kinetic and thermodynamic control in Diles-Alder reaction.

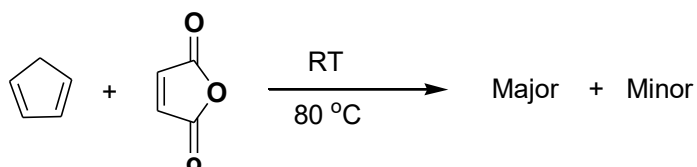
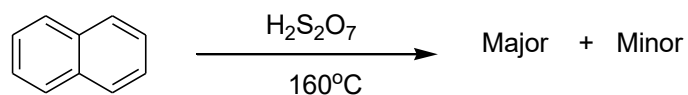
18. Explain the kinetic and thermodynamic control in enolization.

19. Give a brief account on non-classical carbocation.

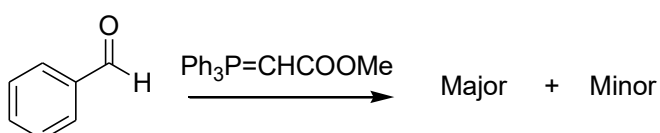
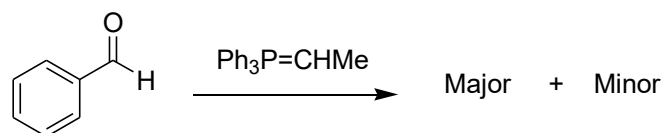
20. Write the products of following reactions giving appropriate reason.



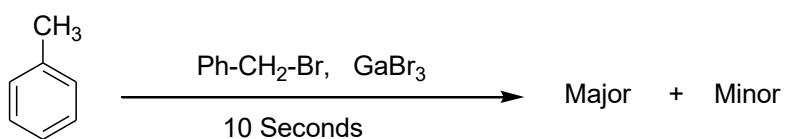
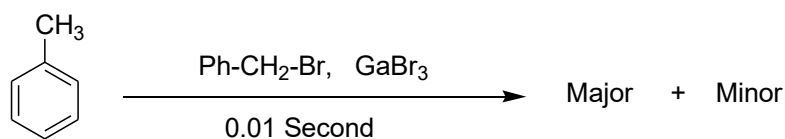
21. Write the products of following reactions giving appropriate reason.



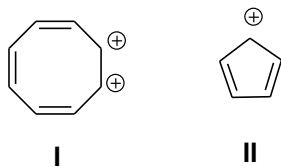
22. Write the products of following reactions giving appropriate reason.



23. Write the products of following reactions giving appropriate reason.



24. Calculate the delocalization energy in the following.



25. Determine the charge density in the following:

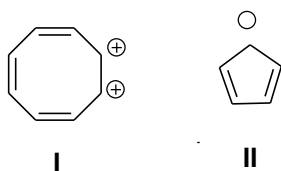


26. Using perturbational molecular orbital theory, calculate the reactivity index (NE) when naphthalene undergoes SE reactions at position 1 and 2.

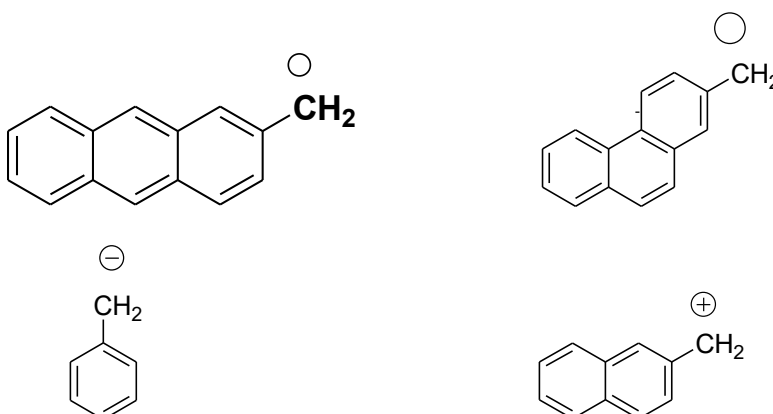
27. State and explain Huckels rule of aromaticity.

28. Explain the concept of alternant and non-alternant hydrocarbons with suitable examples.

29. Calculate the delocalization energy in the following.



30. Determine the charge density in the following:



31. Explain Frost-Musulin's method citing examples.

32. Determine the delocalization energy of benzene and cyclooctatetraene.

33. Determine the delocalization energy of cyclooctatetraene, cyclooctatetraenide dication and cyclooctatetraenide dianion.
34. Determine the delocalization energy of cyclopentadienyl cation, cyclopentadienyl anion and cyclopentadienyl radical.
35. Determine the delocalization energy of cycloheptatrienyl cation, cycloheptatrienyl anion and cycloheptatrienyl radical.
36. Calculate the energy of orbitals in 1,4-butadiene and 1,3,5-hexatriene.
37. Explain various methods for preparation of tropolone.
38. Explain various physical and spectral properties of tropolone.
39. Explain various chemical properties of tropolone.
40. Describe various properties of cyclopentadienyl anion.
41. Give an account on various methods used for the preparation of diazocyclopentadiene.
42. Write an explanatory notes on various physical and chemical properties of diazocyclopentadiene.
43. Give an account on various methods for the preparation of tropone.
44. Explain various physical and chemical properties of tropone.
45. Explain aromaticity in cycloheptatriene, tropylium cation and tropylium anion with the help of molecular orbital diagram.
46. Give an account on various preparation methods for tropylium cation.
47. Give a brief account on various methods for preparation of azulenes.
48. Explain various physicochemical properties of ferrocene.
49. Explain various physical and chemical properties of fulvenes.
50. Give a brief account on annulenes.



**Questions for four marks.**

- 1) Atom economy
- 2) Catalysis
- 3) Supercritical solvents
- 4) Green synthesis
- 5) Ionic liquids
- 6) Kinetic and thermodynamic control in enolization
- 7) Alternant and non-alternant hydrocarbons
- 8) Huckels rule of aromaticity
- 9) Non-classical carbocation
- 10) Impact of nature of ylides on stereochemical outcome of Wittig reaction
- 11) Factors determining endo and exo product formation in Diels-Alder reaction
- 12) Frost-Musulin's method
- 13) Crown ethers
- 14) Fullerenes
- 15) Cyclodextrins
- 16) PMR spectra of [18] annulene
- 17) PMR spectra of [14] annulene
- 18) PMR spectra of [16] annulene
- 19) Rearrangement reactions of tropone
- 20) Electrophilic reactions of tropone
- 21) Catenanes and rotaxanes
- 22) Calculation of energy of orbitals in acyclic systems
- 23) Delocalization energy in aromatic systems
- 24) Microwave assisted organic synthesis
- 25) Cyclodextrins

Seat No.	
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**M.Sc. (Part - II) (Semester - IV) Examination, November- 2018**  
**ORGANIC CHEMISTRY (CBCS) (Paper - XIII)**  
**Theoretical Organic Chemistry-II**

**Sub. Code : 61430**

**Day and Date : Thursday, 22- 11 - 2018**

**Total Marks : 80**

**Time : 02.30 p.m. to 05.30 p.m.**

- Instructions :**
- 1) Attempt in all five questions.
  - 2) Section - I is compulsory.
  - 3) All questions carry equal marks.
  - 4) Answer to the all questions (Section-I,II,III) should written in the same answer book.
  - 5) Figure to the right indicate marks.
  - 6) Attempt at least two questions from section-II and any two questions from Section - III.
  - 7) Use of log table and calculator is allowed.

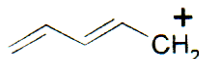
**SECTION-I**

**Q1) Answer the following (one mark each):** **[16]**

- i) What do you mean by kinetically controlled reaction?
- ii) Which one of the following correctly represents bonding in non-classical carbocation?



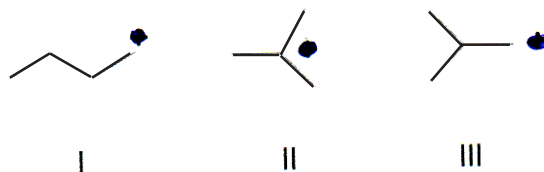
- iii) State True or False: High temperature favors thermodynamic control due to induction of irreversibility.
- iv) Calculate the charge density in the following molecule.



- v) Which intermediate is formed during acetolysis of exo-2-norbornyl tosylate?
- vi) Cite an example of alternant and non-alternant hydrocarbon.

**P.T.O.**

- vii) Give an example of stabilized and non-stabilized ylides.  
 viii) Arrange the following free radicals in increasing order of stability.

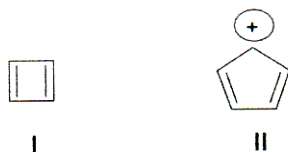


- ix) What are fullerenes?  
 x) What are features of mass spectrum of fullerene?  
 xi) How many glucose units are there in  $\beta$ -cyclodextrin?  
 xii) Give any two applications of crown ethers.  
 xiii) What is Pschorr ring closure?  
 xiv) Give any two methods for generation of free radicals.  
 xv) State True or False: Weaker bases such as alkoxides or amines, and higher temperatures, favour formation of the thermodynamically stable enolate.  
 xvi) Write the names of any two radical initiators.

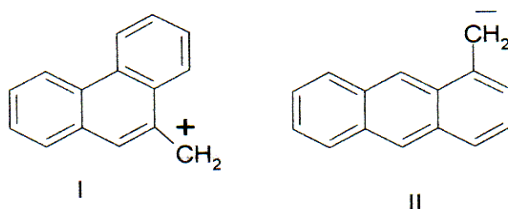
### SECTION-II

- Q2)** a) Using perturbational molecular orbital (PMO) theory, calculate the reactivity index (NE) when naphthalene undergoes SE reactions at position 1 and 2. [8]  
 b) Explain the concept of aromaticity with suitable examples. [8]
- Q3)** a) Give an account on the structure and properties of ferrocene. [8]  
 b) Write a note on : [8]  
 i) Crown ethers  
 ii) Annulenes

Q4) a) Calculate the delocalization energy in the following: [4]

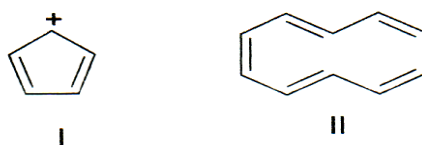


b) Determine the charge density in the following: [4]



c) Write an explanatory note on catenanes and rotaxanes [4]

d) Classify the following compounds as aromatic and non-aromatic giving reason. [4]



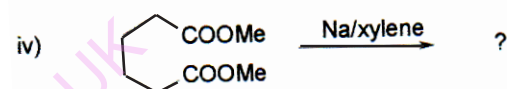
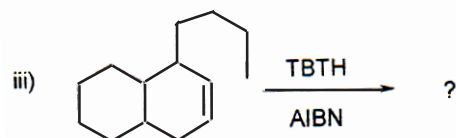
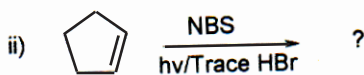
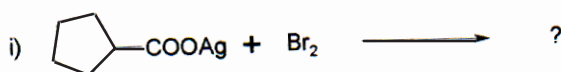
### SECTION-III

Q5) a) Explain the following reactions giving suitable mechanism: [8]

i) Acyloin condensation.

ii) Sandmeyer's reaction.

b) Predict the products giving suitable mechanism. [8]



**Q6)** a) Explain kinetic and thermodynamic control in Wittig and Diels-Alder reaction. [10]

b) Explain the concept of non-classical carbocation. [6]

**Q7)** Write notes on any four: [16]

a) Fullerenes

b) Dewar's reactivity numbers

c) Kinetic and thermodynamic control in sulphonation of naphthalene

d) Alternant and non-alternant hydrocarbon

e) Hunsdiecker reaction



Seat No.	
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**M.Sc. (Part - II) (Semester - IV) Examination, November - 2019**  
**ORGANIC CHEMISTRY (Paper - XIII) (CBCS)**  
**Theoretical Organic Chemistry - II**  
**Sub. Code : 61430**

Day and Date : Monday, 11 - 11 - 2019

Total Marks : 80

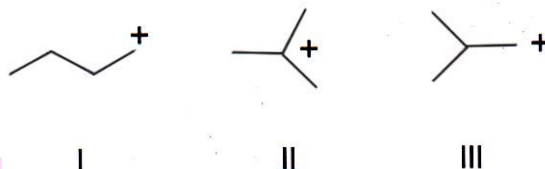
Time : 03.00 p.m. to 06.00 p.m.

- Instructions:**
- 1) Attempt in all five questions.
  - 2) Section - I is compulsory.
  - 3) All questions carry equal marks.
  - 4) Answer to the all questions (Section - I, II, III) Should written in the same answer book.
  - 5) Figures to the right indicate marks.
  - 6) Attempt at least two questions from Section - II and any two questions from Section - III.
  - 7) Use of log table and calculator is allowed.

**SECTION - I**

**Q1) Answer the following: [16]**

- i) What is non-classical carbocation?
- ii) What is kinetically controlled reaction?
- iii) Mention any two methods for generation of free radicals.
- iv) Is tropylium cation aromatic? Why?
- v) How many signals will be observed in the  $^{13}\text{C}$ NMR spectrum of fullerene.
- vi) What is tropone?
- vii) Explain why cyclobutadiene is unstable?
- viii) Arrange the following free radicals in increasing order of stability.



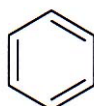
- ix) How many glucose units are there in  $\beta$ - cyclodextrin?

**P.T.O.**

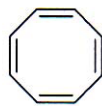
- x) Which metal is used for coupling of alkynes to diynes?
- xi) What is Pschorr ring closure?
- xii) Mention any one use of TBTH.
- xiii) Which technique is used to detect free radicals?
- xiv) State True or False: Weaker bases such as alkoxides or amines, and higher temperatures, favour formation of the thermodynamically stable enolate.
- xv) Why high temperature favours thermodynamic control over the reaction?
- xvi) What are endocyclic protons?

### SECTION - II

- Q2)** a) Applying perturbational molecular orbital theory, calculate the reactivity index (NE) when naphthalene undergoes SE reactions at position 1 and 2. [10]
- b) State and explain Huckels rule of aromaticity. [6]
- Q3)** a) Write the preparation of [14] annulene. [4]
- b) Explain the PMR spectrum of [16] annulene with respect to temperature. [4]
- c) Give an account on preparation methods and chemical properties of tropylium salts. [8]
- Q4)** a) Explain structure, preparation and reactions of ferrocene. [8]
- b) Calculate the energy of the  $\pi$  orbitals in the following: [4]

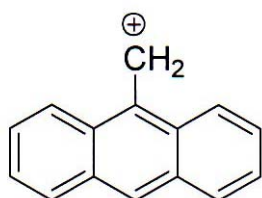


I



II

- c) Determine the charge density in the following: [4]



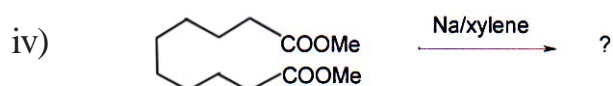
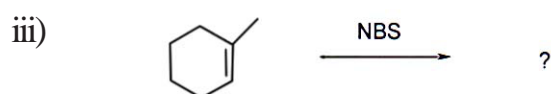
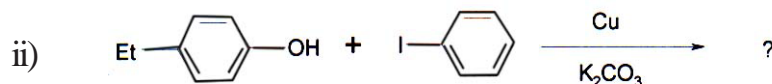
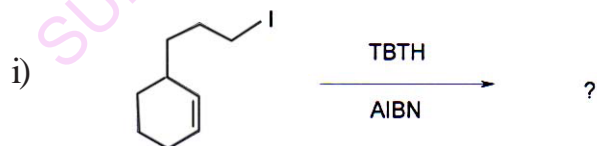
I



II

**Q5) a)** Define free radicals? Explain the mechanism of acyloin condensation and Hunsdiecker reaction. [8]

b) Predict the products giving suitable mechanism. [8]



**Q6) a)** Explain kinetic and thermodynamic control in sulphonation of naphthalene and Diels-Alder reaction. [10]

b) Write an explanatory note on non-classical carbocation. [6]

**Q7)** Write notes on any four: [16]

- Auto-oxidation
- Dewars reactivity numbers.
- Synthesis of fulvenes.
- Alternant and non-alternant hydrocarbons.
- Kinetic and thermodynamic control in Friedel-Craft benzylation of toluene.





Seat No.	
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**M.Sc. (Part - II) (Semester - IV) (CBCS)**  
**Examination, March -2019**  
**ORGANIC CHEMISTRY**  
**Theoretical Organic Chemistry (Paper - XIII)**  
**Sub. Code : 61430**

Day and Date : Saturday, 30 - 03 - 2019

Total Marks : 80

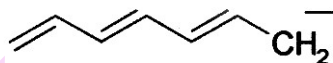
Time : 11.00 a.m. to 2.00 p.m.

- Instructions :**
- 1) Attempt in all five questions.
  - 2) Section-I is compulsory.
  - 3) All questions carry equal marks.
  - 4) Answer to the all questions (Section-I, II, III) should written in the same answer book.
  - 5) Figures to the right indicate full marks.
  - 6) Attempt at least two questions from section-II and any two questions from Section-III.
  - 7) Use of log table and calculator is allowed.

**SECTION - I**

**Q1) A) Answer the following (one mark each:) [16]**

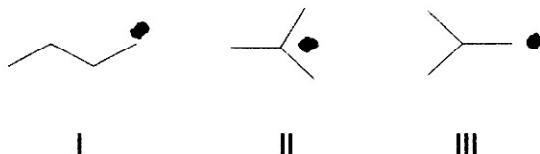
- a) Mention any one reaction in which non-classical carbocation is formed as an intermediate.
- b) Which transition metal is used for the coupling of alkynes to diynes?
- c) Which one of the following correctly represents bonding in non-classical carbocation?  
 $2C-2e^-$   $3C-2e^-$   $3C$ -ionic
- d) Calculate the charge density in the following molecule.



- e) Explain the aromaticity of fullerene ( $C_{60}$ )?

**P.T.O.**

- f) Which spontaneous process converts cumene into cumene hydroperoxide?
- g) Give an example of non-stabilized phosphorus ylides?
- h) Arrange the following free radicals in increasing order of stability.



- i) How is the distribution of products of Friedel-Crafts alkylation of toluene using benzyl bromide and  $\text{GaBr}_3$ ?
- j) How many glucose units are there in  $\beta$ -cyclodextrin?
- k) Is tropone aromatic? Justify your answer.
- l) Give an example of non-alternant hydrocarbon.
- m) How are free radicals detected?
- n) Mention any two methods for generation of free radicals.
- o) State True or False: Weaker bases such as alkoxides or amines, and higher temperatures, favour formation of the thermodynamically stable enolate.
- p) Is cyclopentadienyl cation aromatic, non aromatic or antiaromatic? Give reason.

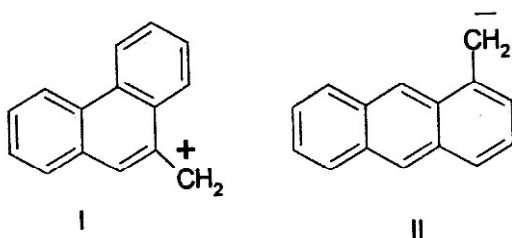
### SECTION - II

- Q2)** a) Applying perturbational molecular orbital (PMO) theory, calculate the reactivity index (NE) when naphthalene undergoes SE reactions at position 1 and 2. [8]
- b) Describe Huckels rule of aromaticity with suitable examples. [8]
- Q3)** a) Give an account on the structure and properties of ferrocene. [8]
- b) Explain the following: [8]
- i) Annulenes
- ii) Catenanes and rotaxanes

Q4) a) Calculate the delocalization energy in the following: [5]



b) Determine the charge density in the following: [5]



c) Explain mechanism of allylic bromination using N-bromosuccinimide. [3]

d) Explain mechanism of conversion of alkyl halides to alkanes using TBTH. [3]

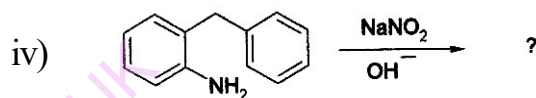
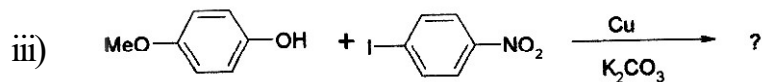
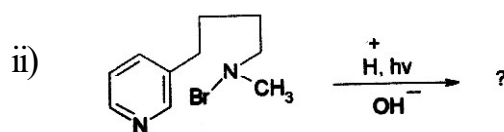
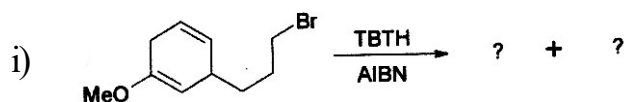
### SECTION - III

Q5) a) Explain the following reactions giving suitable mechanism: [8]

i) Acyloin condensation

ii) Auto-oxidation

b) Predict the products giving suitable mechanism [8]



**Q6) a)** Explain kinetic and thermodynamic control sulphonation of naphthalene and Wittig reaction. [10]

b) Explain the concept of non-classical carbocation. [6]

**Q7) Write notes on any four:** [16]

a) Fullerenes

b) Hunsdiecker reaction

c) Kinetic and thermodynamic control in Diels-Alder reaction

d) Abstraction reaction

e) Crown ethers

