Third Semester M.Sc APPLIED CHEMISTRY

AP3C09 ADVANCED SYNTHETIC ORGANIC CHEMISTRY

MODEL QUESTION PAPER

Time: Three hours Total Weight: 30

Section A

*(Answer any **10** questions. Each question carries a weight of **1**)*

01. Give examples of chromium and DMSO based oxidation of alcohols to carbonyl compounds.
02. Discuss any two methods for the synthesis of diols from alkenes using Osmium.
03. What is Mitsunobu reaction?
04. What is Baylis-Hilman reaction? Explain its mechanism.
05. Give the structures of NBS and DDQ.
06. Give one method each for the synthesis of (a) thiophene (b) Imidazole (c) Oxazole.
07. Discuss the contraction and expansion of ring systems. Give an example of Demjenov reaction.
08. Discuss asymmetric Diels-Alder reaction.
09. What are click reactions?
10. Explain asymmetric induction.
11. How are alkaloids classified?
12. What is Umpolung equivalence? Give one example.
13. Explain the importance of Green solvents in organic synthesis.

(10×1=10 weights)

Section B

*(Answer any **5** questions. Each question carries a weight of **2**)*

14. Discuss the method of synthesis of epoxide from alkenes. Explain the mechanism of (a) Sharpless asymmetric epoxidation and (b) Shi epoxidation.
15. Discuss the photochemical approaches for the synthesis of four membered rings.
16. Explain the method of construction of macrocyclic rings by ring closing metathesis.
17. Discuss the mechanism and applications of inter and intra molecular ketene cycloaddition.
18. How will you synthesize esters and lactones from ketones? Explain Baeyer-Villiger oxidation.

19. Write note on protein biosynthesis.
20. Explain the mechanism of host-guest complex formation. Comment on the forces involved in molecular recognition.
21. Discuss the green alternatives of organic synthesis with special reference to electrophilic aromatic substitution reactions.

(5×2=10 weights)

Section C

*(Answer any **2** questions. Each question carries a weight of **5**)*

22. Write an essay on the applications of the metal and non-metal based oxidations of (a) alcohols and (b)alkenes in organic synthesis. Illustrate with examples.
23. Write an essay on metal mediated C-C and C-X coupling reactions with special reference to (a) Suzuki coupling (b) Heck reaction (c) Suzuki-Miyaura coupling (d) Glaser coupling and (e) Nozaki-Hiyama reaction.
24. Discuss the basic principles of retero synthesis. Explain one group C-C and two group C-C disconnections.
25. What are molecular receptors? Explain the structure, functions, and applications of (a) cyclodextrins (b) crown ethers (c) cryptands (d) tweezers and (e) carbon nanocapsules as receptors.

(2×5=10 weights)

AP3C10 CHEMISTRY AND BIOCHEMISTRY OF FATTY ACIDS

MODEL QUESTION PAPER

Time: Three Hours Max. Weight: 30

Section A

*(Answer any **10** questions. Each question carries a weight of **1**)*

01. What are sphingolipids? How do they differ from phospholipids?
02. What are known as ω-3 fatty acids? Give examples. What is their significance?
03. For the analysis of a mixture of fatty acids by gas chromatography it is better to convert the acids to the methyl ester. What are the reasons for this?
04. Show how molecular distillation is useful for fatty acid study.
05. Making use of spectral studies how would you distinguish oleic and elaidic acids?
06. Give the structure of 1, 2-diacyl sn-glycero 3-phosphate.
07. Give the name and structure of a naturally occurring branched chain saturated fatty acid. Where does it occur?
08. Give the name and structure of two fatty acids which contain conjugated double bonds.
09. Give the structure of a widely occurring dienic acid and a trienic acid.
10. What are the polymorphic modifications of glycerides?
11. Give the structures of A, B and C:

$$\text{Oleic acid} \xrightarrow{OsO_4} A \xrightarrow{HIO_4} B + C$$

12. What are nitrogen derivatives of fatty acids? Give their synthetic applications.
13. Why are most naturally occurring fatty acids even numbered?

(10×1=10 weights)

Section B

*(Answer any **5** questions. Each question carries a weight of **2**)*

14. How are prostaglandins classified based on structure?
15. How are the following obtained from castor oil?

    a) n-heptaldehyde , b) 10-undecenoic acid, c) octane-2-ol, d) sebacic acid.

16. Outline a synthesis of petroselenic acid using starting materials containing less than 10 carbon atoms.

17. Write a note on non nutritional functions of edible fats.

18. Write a note on the application of UV and IR spectroscopy in the study of fatty acids.

19. Write a note on artificially produced fatty acids.

20. Briefly describe the production and uses of fatty acid salts.

21. Explain the crystal properties of fatty acids.

(5×2=10 weights)

Section C

*(Answer any **2** questions. Each question carries a weight of **5**)*

22. Give brief accounts on:
    a) Metabolism of fats in humans; and
    b) Biosynthesis of fats.

23. Discuss:
    a) Biological functions of prostaglandins ; and
    b) Biosynthesis of prostaglandins.

24. Give an account of the chromatographic techniques in the separation and analysis of fatty acids.

25. Give a brief account of the followings:
    a) Polymerisation reactions of fatty acids.
    b) Molecular distillation method employed in the separation of individual fatty acids.
    c) Melting point behaviour of fatty acids.

(2×5=10 weights)

AP3C11 ESSENTIAL OILS AND AROMATICS

MODEL QUESTION PAPER

Time : 3 hours Total Weight : 30

Section A

*(Answer any **10** questions. Each question carries a weight of **1**)*

01. What is an essential oil? How does it differ from fixed oil?
02. Enfleurage is the best method for the isolation of jasmine oil. Why?
03. What product is obtaines when α- pinene is treated with 1% alkaline $KMnO_4$?
04. Draw the structure of caryophyllene and iso caryophyllene.
05. How would you identify between bisabolene and zingeberene by U.V Spectoscopy.
06. What is the main source of limonene?
07. Alcohol is not used for the extraction of fresh flower. Why?
08. What is the dehydration product of isoborneol?
09. Write down the IUPAC name of Camphor.
10. What are the ozonolysis products of Citral?
11. What is turpentine oil? How it is isolated?
12. What is concrete oil?
13. What product is obtained when ocimene is heated in the absence of air?

(10×1=10 weights)

Section B

*(Answer any **5** questions. Each questions carries weight of **2**)*

14. What is enfleurage? Illustrate with example.
15. Describe the use of U.V Spectroscopy in the structural characterisation of terpenoids.
16. Give an account of the botanical source, physical characteristics and use of the following oils.

    a) Euecalyptous oil, b) Rose oil, c) Clove oil, d) Peppermint oil

17. What is supercritical fluid extraction?
18. Illustrate the synthesis of β- ionone from citral.
19. Explain the biosynthesis of sesqueterpenoids.
20. Discuss the function of essential oils in plants.
21. Discuss the use of IR spectroscopy in the structural characteristics of terpenoids.

(5×2=10 weights)

Section C

*(Answer any **2** questions. Each question carries weight of **5**)*

22. Illustrate the total synthesis of caryophyllene.
23. Write notes on:

    a) Hydrodistillation b) Expression and c) Maceration.

24. Explain the synthesis of camphor.
25. Citing specific examples briefly explain application of chemical methods on establishing the structure of terpenoids.

26. (2×5=10 weights)

AN3C12/AP3C12/ CH3C12/ PH3C12/ PO3C12

SPECTROSCOPIC METHODS IN CHEMISTRY

(common to all branches of Chemistry)

MODEL QUESTION PAPER

Time: Three hours Total Weight: 30

Section A

*(Answer any **10** questions. Each question carries a weight of **1**)*

1. How would the fluorine NMR spectrum for F-CH_2-CO-CH_2-CH_3 appear?
2. How will you distinguish between $\pi \rightarrow \pi^*$ and $n \rightarrow \pi^*$ transitions? Apply the effect of solvation to illustrate this.
3. Predict the signal pattern in DEPT-90 and DEPT- 135 spectra of phenyl acetic acid.
4. A trisubstituted benzene possessing one bromine and two methoxy substituents exhibits three aromatic resonance bands at 6.40, 6.46 and 7.41 ppm in its proton NMR spectrum. What is the substitution pattern?
5. Explain ORD with example.
6. What is meant by finger printing in IR spectroscopy?
7. How will you confirm the conversion of benzene to cyclohexane with ^{1}H NMR and ^{13}C NMR spectroscopy?
8. What is MALDI? Explain with example.
9. Comment on the differences between the scales in ^{1}H and ^{13}C NMR spectroscopy.
10. How will you estimate ring strain using IR and UV-Visible spectra.
11. Predict the proton and deuterium NMR spectra of D-CH_2-O-CH_3 (for D, I=1).
12. What are the applications of 2D- COSY spectra?
13. Sketch Karplus curve. Explain its characteristic features.

(10×1=10 weights)

Section B

*(Answer **5** questions. Each question carries a weight of **2**)*

14. Explain how IR spectroscopy can be applied to predict the product formation at each step in the following reaction series.

Benzaldehyde → Benzoin → Benzil → Benzilic acid.

15. Apply ^{1}H NMR and ^{13}C NMR spectroscopic techniques and explain how will you confirm the following conversions. Explain all characteristic features of the ^{1}H NMR and ^{13}C NMR of the substrates and the products.

a) $CH_3\text{-}CH_2\text{-}CH_2\text{-}OH \xrightarrow{[O]} CH_3\text{-}CH_2\text{-}CHO$

b) $CH_3\text{-}CH(OH)\text{-}CH_3 \xrightarrow{[O]} CH_3\text{-}CO\text{-}CH_3$

16. Sketch the H-H HOMOCOSY of (a) 2- chloro propane and (b) ethanol.
17. Write a note on (a) axial halo ketone rule and (b) Cotton effect.
18. Discuss the applications of HRMS and MS-MS techniques in structure analysis.
19. Define NOE. Explain Nuclear Overhauser Enhancement based on cross polarization theory.
20. Predict the structure of the compound with the following spectral characteristics:
    UV: 290 nm
    IR : 2980, 1718, 1440 cm^{-1}
    ^{1}H NMR : 2.3ppm (q), 2.15ppm(s), 1.1ppm(t)
    Mass (m/z) : 72(M^{+}), 43 (base peak), 29
21. Sketch the approximate ^{1}H NMR and ^{13}C NMR and mass spectra of 2-butenone. Explain the spectral features.

(5×2=10 weights)

Section C

*(Answer any **2** questions. Each question carries a weight of **5**)*

22. Define and explain spin-spin coupling. Using tree diagram method explain AX, AX_2, AX_3, A_2X_3, AB and ABC type coupling.
23. Write an essay on the application of DEPT, INEPT, and RINEPT in the structural elucidation of organic compounds. Illustrate the application of DEPT with examples.
24. (a). Predict the structure of the compound (commercial sample) with the following spectral characteristics and justify your answer.

    MF: $C_4H_{10}O$; IR: 3450 (broad), 2980, 1450, 1200, 1050cm^{-1}.

    ^{1}HNMR: 1.5 (3H, t), 2.8 (2H, dq), 3.4 (1H, m), 4.5 (1H, s), 2.1 (3H, d).

    ^{13}C NMR: 22.6, 68.7, 32.0, 9.9 ppm.

DEPT 45: 4 signals, DEPT 90 : 1 signal, DEPT 135: 3 +ve and 1 –ve signals.

(b). Discuss the theory and applications of MRI.

25. (a) An ester $C_5H_8O_2$ shows the following ^{13}C spectral results (off-resonance decoupled).

20 ppm (q), 50 ppm (q), 126 ppm (t), 130 ppm (s) and 160 ppm (s).

Predict the structure.

(b) Determine the structure of the compound with the following spectral characteristics.

MF: $C_5H_9NO_4$; IR: 1750, 1562, 1320cm^{-1}.

^{1}HNMR: 5.2 (q), 4.2 (q), 1.8 (d), 1.3 (t).

^{13}C (ppm)	PT 135	PT 90
		peak
		peak
		peak
	peak	peak

(2×5=10 weights)