

Ministry of Higher Education and Scientific research



**Department of Chemistry**

**College of Science**

**University of Salahaddin-Erbil**

**Subject: Stereochemistry**

**Course Book – (Year 3), 2<sup>nd</sup> semester**

**Lecturer's name: Prof. Dr Media Noori Abdullah**

**Academic Year: 2023/2024**

# Course Book

<b>1. Course name</b>	<b>Stereochemistry</b>
<b>2. Lecturer in charge</b>	<b>Prof. Media Noori Abdullah</b>
<b>3. Department/ College</b>	<b>Chemistry/ Science</b>
<b>4. Contact</b>	<b>e-mail: media.abdullah@su.edu.krd</b>
<b>5. Time (in hours) per week</b>	<b>Theory: 3h Practical: 2 groups, total 4h</b>
<b>6. Office hours</b>	<b>On my Free times</b>
<b>7. Course code</b>	<b>None</b>
<b>8. Teacher's academic profile</b>	<b><a href="https://sites.google.com/a/su.edu.krd/media-abdullah-2019/2020">https://sites.google.com/a/su.edu.krd/media-abdullah-2019/2020</a></b>
<b>9. Keywords</b>	<b>None</b>
<b>10. Course overview:</b> This course is crucial and recommended for stage three undergraduate students to understand Stereochemistry of the molecules, so the study will be sufficient and comprehensive. At the end of the course, the student will gain full knowledge for future employment.	
<b>11. Course objective:</b> <b>By the end of the course, the students will be able to</b> <ul style="list-style-type: none"> <li>• Draw the possible stereoisomers of various molecules.</li> <li>• Recognise symmetry in organic molecules</li> <li>• Classify stereoisomers</li> <li>• Recognize a stereogenic (chiral) centre in a molecular structure</li> <li>• Various representations of three-dimensional molecules.</li> <li>• Distinguish between enantiomers, diastereomers, and meso compounds and explain their physical properties, especially in chiral environments such as the human body.</li> <li>• Use the Cahn-Ingold-Prelog convention to correctly assign R and S nomenclature.</li> <li>• Various nomenclature of stereoisomers to define them properly.</li> <li>• Define chirality and identify stereocenters in organic compounds, including pharmaceutical drugs <ul style="list-style-type: none"> <li>• Define racemic mixture and determine the enantiomeric excess of a mixture</li> <li>• Explain some implications of stereoisomerism with respect to health and well being</li> </ul> </li> </ul>	
<b>12. Student's obligation</b> Students are obliged to attend all theoretical lectures and practical sessions for around 14 weeks; quizzes may be given after each lecture. The practical sessions are to submit a report for each completed experiment, reviewed and corrected report will be returned to the student.	
<b>13. Forms of teaching</b> <ul style="list-style-type: none"> <li>○ Lecture notes were prepared in Microsoft PPT, and ChemDraw Ultra for drawings, and presented to the students using PowerPoint by Data Show. The lecture indicates an introduction, a brief review of the last lecture, explaining every slide shown, troubleshooting, and solving sample questions. The lecture ends with questions/answers and or quizzes sometimes.</li> <li>○ The notes are usually uploaded for the students on the e-Learning website.</li> </ul>	

- After every exam is assigned for the students, questions are corrected, marks are rewarded, and the following lecture will be discussed to solve the exam questions. Exam answer papers are to be saved for future reference.
- The exam paper covers most of the lectures given and indicated: Exam instructions, MCQ (multiple choice question), definitions, chemical equations, explanations, drawings, reasons, calculations, comparisons...etc. The questions are usually clear, direct, and obvious, starting from easy, to medium to hard. All student marks including attendance and quizzes shall be displayed on the department notes board. All-year student effort will be calculated and added to the summer exam along with the practical marks out of 100%.

#### 14. Assessment Scheme

The course marks out of 100%, breaking down to 50 marks (25 marks for exams including quizzes and classroom activity, and 25 marks for practical) plus 50 marks for the final summer theory exam (50 mark sitting exam).

#### 15. Student learning outcome:

The students will learn from the lecturer, and other sources of information including Educational Websites, books from the library, etc

#### 16. Course Reading List and References:

- 11- Stereo Chemistry of Carbon Compounds (Advanced Chemistry) by Ernest L. Eliel
- 2- Elements of Stereo Chemistry: Ernest L. Eliel (the father of Stereo Chemistry)
- 3- Principle and applications of Stereo Chemistry Michael North.
- 4- Introduction to Stereo Chemistry by Kurt Mislow.
- 5- Drug Stereo Chemistry: Analytical Methods and Pharmacology, Third Edition, Irving W. Wainer.
- 6- Topics in Stereochemistry, Vol. 23, A JOHN WILEY & SONS, INC., PUBLICATION, Copyright 2003.
- 7- Stereochemistry Conformation and Mechanism, Kalsi, P.S. (2007), New Age International(P) Limited, Publishers, New Delhi.
- 8- Organic Chemistry Vol-I, Singh, J. and Yadav, L.D.S. (2013)  
Stereochemistry of Organic Compounds, A Pragati Prakashan, Meerut. Nasipuri, D. (2012) New Academic Science, UK.
- 9- A Text Book of Organic Chemistry, Bahl, A. and Bahl, B.S. (2011) S. Chand Publisher, New Delhi.  
From Google Internet search (www.google.com), YouTube and Journals

#### 17. The Topics:

**Week 1-14, Stereochemistry, Constitutional or structural isomers, Geometric isomers (cis-trans and E and Z), Conformational isomers, Fisher projection, Chirality (chiral and achiral molecules), Racemic mixture, Cahn-Ingold- Prelog systems, R and S., Configurations, Resolution of Enantiomers, Molecules with more than one chiral center, Diastereomers, Meso compounds, stereo features of Drugs, Stereochemistry of Chemical reactions, Mechanism of stereo addition reaction.**

#### Lecturer's name

Prof. Media Noori Abdullah

#### 18. Practical Topics (If there is any)

Stereochemistry experiments including: Each Wednesday and Thursday a 2h practical session will be compulsory for student to practice. Experiments are related to preparation and stereochemistry of Organic compounds.

Dr. Media Noori Abdullah 4h  
Dr. Peshawa Oso 12h  
Jala Bahjet 16h  
Naween Mushir 16h

**Experiment titles:**

1-Preparation of Benzamide and Benzanilide

2-Hydrolysis of Benzamid

3-Nitration of Benzamide and benzanilide

4-Hoffman degradation

5- Benzil rearrangement

6-Preparation of pinacol

7-Pinacol rearrangement

9-Preparation of Schiff base

10-Preparation of quinoxalin

11-Preparation of Aryl Halide

12-Preparation of Anthraquinone

13-Deils Alder reactions

14- Aldol condensation

15-Preparation of Isoborneol

16- Preparation of Diazonium salt and

17-Coupling reaction

**19. Examinations: Theory**

**Sample Question paper given to students**

**University of Salahaddin** 3<sup>rd</sup> stage Stereochemistry exam. Time allowed 1.0 hr.

**Science College, Chemistry department.** (Answer all questions on this paper). **Student name:**

Q1. Fill the spaces with suitable words.

1. Stereoisomers are compounds with the same ..... but  
different.....in space.

2. Enantiomers are..... that are non-superimposable  
.....
3. Diastereomers are stereo isomers that are .....,  
different.....with different.....
4. Asymmetric centre.....carbon with.....groups attached.
5. Optical activity means, the ability to ..... the plane of  
plane.....light.
6. Chiral compound, a compound that is..... (Chiral compound  
will.....light).
7. Polari meter ,.....that measures the optical rotation  
of.....compound.
8. Mirror images that can be superposed are.....  
(Not.....).

**Q2. What is the maximum number of stereoisomers for each of the following groups?**

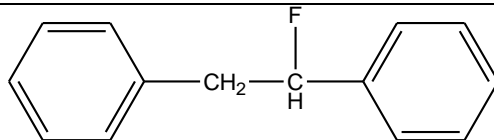
- a. 1, 2-dibromo-1-phenylpropane.
- b. 1, 2-dibromo-2-methyl-1-phenylpropane.
- c. 2, 3, 4, 5-tetrahydroxypentanol.

**Q3. Assign (R) and (S) Configuration to the Stereoisomers of**

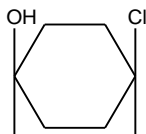
- a. 2-butanol
- b. 1-bromo-1,2-diphenylpropane (Atomic numbers, Br= 35, C=6, H=1)

**Q4. Star any Chiral Carbon atoms in the following structures.**

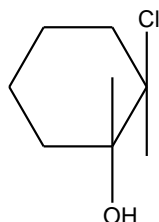
a.



b.



c.



### 19. Examinations: Practical Part

1-Explain Why amide have quite high boiling point.

2-Carboxylic acid derivatives have more reactivity to nucleophilic acyl substitution reactions than aldehydes and ketones.

3-Acid chlorides are more reactive toward nucleophiles acyl substitution than amid

4-Write the mechanism for the preparation of Benzamil.

6-Explain why amid are less reactive to Nucleophilic attack.

7-Write an equation for preparing Nitronium ion.

8-Explain why Benzene does not Undergo addition reaction.

9-Write a mechanism for preparation of benzylic acid.

10-Whate is the Hoffman degradation of Acetamide

11-Explain the low yield of m-nitro benzanilide in Nitration of benzylic acid.

12-Unsubstituted imines are unstable while substituted imines are very stable?

13-Explain why 1, 1-diphenylehtandiol gives diphenyl acetaldehyde not phenyl acetophenone, with mechanism.

**20. Extra notes:**

None.

**21. Peer review** پى داچوونو ديهاهن

This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.

*(A peer is person who has enough knowledge about the subject you are teaching; he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).*

نهم كور سبوو كه دمه بئ نله لايه نهاوه ن كينه كاديميه و سهير بكرى توناو هرؤكي بابته كانيك ؤر سه كه پسه ندبكاتو جهندو وشيه ك

بنوس بئ نله سه شياو يناو هرؤكيك ؤر سه كه و واژووى له سه بكات.

هاوه نله سه كه ز انيار يه بئ ت له سه كور سه كه ده بيتل هيز انستيله مام ؤستا كه متر نه بئ ت.