Ministry of Higher Education and Scientific Research

Scientific supervision and evaluation device

Department of Quality Assurance and Academic Accreditation

Academic program description form for colleges and institutes

For the academic year 2020-2021

University: Basrah

College/Institute: Sciences

Scientific Department: Chemistry

Date of filling the file: 2023

Signature:

Chair of Chemistry Department

Prof. Dr. Salah Shaker Hashem

Date:

Signature:

Scientific assistant

Prof. Dr. Alaa Hassan Abdu!!ah

Date

Check the file before

Division of Quality Assurance and University Performance

Name of the Director of Quality Assurance and University Performance Division:

The date / /

The signature

Approval from the Dean of the College of Science

Assist. Prof .D. Jalal Jabbar Hassan

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the signature :	**the signature :**
Name of scientific assistant: **Prof. Dr. Alaa Hassan Abdullah**	**Name of department head:** **Prof. Dr. Salah Shaker Hashem**
the date :	**the date :**

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Assist.Prof.Dr. Jalal Jabbar Hassan

Description of the academic program

This academic program description provides a summary of the most important characteristics of the program and the learning outcomes that the student is expected to achieve, demonstrating whether he or she has made the most of the opportunities available. It is accompanied by a description of each course within the program

1. Educational institution	**University of Basra - College of Science**
2. Scientific department/center	**chemistry department**
3. Name of the academic or professional program	**Chemistry**
4. Name of the final certificate	**BSC**
5. Academic system: Annual/courses/others	**Courses**
6. Accredited accreditation program	**RSC**
7. Other external influences	**Simplicity of laboratory equipment, lack of chemicals, lack of laboratory equipment**
8. Date the description was prepared	**2023**
9. Objectives of the academic program • **Preparing and graduating qualified cadres to work in the fields of various branches of chemistry.** • **Conducting academic and applied scientific research in order to gain a broader understanding and develop appropriate solutions to relevant problems and institutions.** • **Enabling students to know the basic information in chemistry according to the latest scientific developments in this vital field of science.**	

10. Required Program Outcomes and Teaching, Learning and Assessment Methods

a) Cognitive goals.

- **getting information**
- **Discussing and comparing information**
- **Conducting scientific reports and research**
- **Communication, collaboration and teamwork**

b) The objectives of the program are:

- **The skill of obtaining scientific and electronic information**
- **The skill of academic writing of research and reports, discussing them, and group work**
- **The skill of training on some modern and advanced scientific software such as computational chemistry**

Teaching and learning methods

- **Applying e-learning and distance learning platforms and communicating with students to deliver scientific information remotely.**
- **Adopting curricula based on modern scientific sources.**
- **Using visual and in-kind explanations and giving lectures in interactive, video, and PDF format.**
- **Scientific trips to the oil and medical sectors.**

Evaluation methods

1. **Direct daily, monthly or final theoretical and practical exams and tests.**
2. **Electronic exams and tests.**
3. **.Approval of scientific reports and research related to various course topics.**

c) Emotional and value-based goals:

- **Increasing the student's sense of patriotism by introducing him to scientific honesty, credibility, the importance of professional ethics in the field of work, and the necessity of preserving state property and investing the country's resources in a way that serves the citizen and improves his way of living.**
- **Enhancing the spirit of teamwork through joint laboratory and scientific work for students**

d) Transferable general and qualifying skills (other skills related to employability and personal development).

- **Use of the English language in some courses.**
- **Training on using advanced software**
- **Training in leadership and teamwork.**
- **Training in managing and writing research projects in academic writing.**

• **Training on using some applications for writing sources, such as Mendeley, as well as using PowerPoint to present their writing.**	

1. Planning for personal development
1. Providing modern, accredited curricula. **2. Providing training opportunities in the various oil, medical and industrial sectors for students.** **3. Adopting modern illustrative and visual methods.** **4. Holding self-development lectures to raise the level of awareness and the ability to get rid of problems or find solutions to them.**
2. Admission standard (setting regulations related to admission to the college or institute)
- Central admission - for morning studies **- Direct submission to evening studies - according to grade and competition**
3. The most important sources of information about the program
The updated course system for the Department of Chemistry - College of Science - University of Basra for the year 2020-2021.

Curriculum skills chart																			
Learning outcomes required from the Programme																			
General and qualifying skills that are transferred.)Other skills related to employability and personal development				Emotional and value goals				Program-specific skill goals				Cognitive goals				Basic Or optional	Course name	Course code	Year/level
D4	D3	D2	D 1	C4	C3	C2	C1	B 4	B 3	B2	B1	4A	A3	1A	A1				
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Electronic structure of the atom	101chem	The first
																compulsory department	Chemical bonding	Chem102	
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Volumetric analysis	Chem131	The first
																compulsory department	Weight Analysis	132 Chem	
		X	X		X	X	X		X	X	X	X	X	X	X	College compulsory	Electrical and magnetic principles	phs103	The first
																College compulsory	General electronics	phs108	
		X	X		X	X	X		X	X	X	X	X	X	X	College compulsory	1 Calculus	math101	The first

																College compulsory	Mathematics for chemistry	115math	
		X	X		X	X	X		X	X	X	X	X	X	X	College compulsory	Programming in BASIC language	comp127	The first
		X	X		X	X	X		X	X	X	X	X	X	X	College compulsory	sport	sport101	The first
		X	X		X	X	X		X	X	X	X	X	X	X	College compulsory	Arabic lang.	Lec.101	The first
		X	X		X	X	X		X	X	X	X	X	X	X	College compulsory	Human rights principles	th101	The first
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Chemistry of represented elements	201 Chem	the second
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Coordination Chemistry	202 Chem	the second
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Aliphatic organic compounds:	211 Chem	the second
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Aromatic Organic Chemistry:	212 Chem	the second
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Thermodynamic:	221 Chem	the second
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Electochemistry:	222 Chem	the second
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	biochemistry1	242 Chem	the second

		X	X		X	X	X		X	X	X	X	X	X	X	College compulsory	Solve differential equations	math214	the second
		X	X		X	X	X		X	X	X	X	X	X	X	College compulsory	Applications in Matlab language	comp260	the second
		X	X		X	X	X		X	X	X	X	X	X	X	Compulsory University	Concepts of freedom and democracy	lec201	the second
		X	X		X	X	X		X	X	X	X	X	X	X	College compulsory	Geochemistry	G275	the second
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Stereochemistry	313 Chem	the third
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Mechanics of organic reactions	314 Chem	the third
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Kinetic chemistry	321 Chem	the third
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Quantum chem	323 Chem	the third
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Spectroscopic chemistry	Chem324	the third
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Biochemistry 2	Chem342	the third
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Industrial chem.	Chem351	the third
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	polymer	Chem352	the third

		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	English lang.	Lec301	the third
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Organometallic	Chem 301	the third
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Heterocyclic chemistry	Chem315	the third
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	photochemistry	Chem325	the third
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Separation methods	Chem334	the third
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Clinical biochemistry	Chem343	the third
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Oil and petrochemical technology	Chem353	the third
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Identification of organic compounds:	Chem416	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Instrumental analysis chemistry	Chem431	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	compulsory department	Research project	Chem490	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	College compulsory	Environmental awareness	400	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Transition metals chemistry:	Chem401	the fourth

		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Inorganic Nanomaterials:	Chem402	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Chemistry of non-aqueous solution	Chem403	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Bio-inorganic chemistry	Chem404	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Selected topics in organic chemistry	Chem417	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Advanced organic chemistry	Chem418	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Advanced MRI	Chem425	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Radiological and Nuclear:	Chem426	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Selective Topics in Physical Chemistry:	Chem427	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Advanced electrochemistry	Chem428	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Electroanalytical chemistry	Chem432	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	biotechnology	Chem445	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Introduction to petrochemicals	Chem454	the fourth
		X	X		X	X	X		X	X	X	X	X	X	X	Optional department	Polymer Processing:	455 Chem	the fourth

		X	**X**		**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**	**X**	**X**	**Optional department**	**Environmental chemistry and pollution**	**Chem461**	**the fourth**

Description of graduates in the Faculty of Science / Department of Chemistry

Years of study and certificate awarded	Graduate description	Functional classification	Employment
4 years (Bachelor of Science)	Research Assistant (Eng. Researcher)	Academic work	Ministry of Higher Education and Scientific Research
	Chemical assistant	State ministries	Ministry of Health and Environment - Ministry of Oil Ministry of Water Resources - Ministry of Education Ministry of Industry including: pharmaceutical companies and manufacturing laboratory materials.

Description of the academic program

Description of the courses of the Department of Chemistry

First level -

CHEM101 / Electronic structure of the atom:

***Derive the predicted ground-state electron configurations of atoms.**

***Identify and explain exceptions to predicted electron configurations for atoms and ions.**

***Relate electron configurations to element classifications in the periodic table.**

Curriculum CHEM 101:

1-Introduction

The nature of light and electromagnetic radiation - atomic spectra - black body radiation - the phenomenon of the photoelectric effect.

2-Bohr model of the hydrogen atom

Bohr's hypotheses - spectrum of the hydrogen atom - Summerfield's theory.

3- Quantitative theory

Wave mechanics - the dual nature of the electron - de Broglie's hypothesis - Heunberg's imprecision principle - interpretation of quantum mechanics for the hydrogen atom - Schrodenker's equation - quantum numbers and orbitals - electron density and diffusion curves - electron spin - orbital energies.

4-Multi-electron atoms

Electronic arrangement of elements - principle of electronic construction - groups and cycles.

5-Term symbols For steady states and excited states.

6-The periodic table of the elements

Locations of elements in the periodic table - metallic and nonmetallic characteristics.

7-Periodic properties of the elements

Blocking constant - atomic radius - ionization potential - electronic affinity – electronegativity

References

4. **H. Gray, Electron and chemical bonding, 1965.**
5. **R. Chang , Chemistry ,7th edition , 2002.**
6. **R. H. Petucci et.al , General chemistry : Principle and modern applications , 9th edition , 2007.**
7. **G. L. Miessler and D. A. Tarr , Inorganic chemistry , 3rd edition , 2003.**
8. **Any Text book of inorganic chemistry & general chemistry.**

CH102 /Chemical bonding:

The aim of this course is to give the student the ability to gain experience and understanding the basic concepts of chemical bonding, and how bonding occurs in chemical compounds, whether covalent or ionic bonding, which enables him to study the concept of chemical bonding with comprehensive clarity, and acquires the scientific skills necessary to develop his skill in understanding modern and old theories of chemical bonding.

Curriculum chem 102

1-The basic principles of chemical synthesis

1-1-Lewis structure and the octet rule

2-1 - Ionic affinity and ionic compounds

- solubility - energy of the crystal lattice - stability of ionic compounds - Haber cycle, ionic radii and methods for measuring them - Paulnick's method - crystalline structures such as sodium chloride and cesium chloride.

3-1-Covalent bonding - bond energy - bond polarity - electronegativity.

4-1-Oxidation number and total charge

2-Molecular geometry and molecular shape

1-2-Repulsion between electronic pairs (VSEPR) in valence shells.

2-2-dipole moment

3-2-Equivalence theory - hybridization - interference.

4-2-The theory of the molecular orbital - the hydrogen molecule - the arrangement of the bonds.

5-2-Symmetric and asymmetric diatomic molecules.

-6-2Examples of compounds - covalent compounds - linear compounds - planar triangle compounds - tetrahedral compounds.

References:

-1 Electrons and chemical bonding by H. Gray

-2 **Basic inorganic chemistry by cotton and Wilkinson**

-3 **Concept in inorganic chemistry by Dogles**

CH131 / Analytical chemistry:

Identifying the methods of preparing compounds and estimating the concentration of an unknown substance through the titration process.

Curriculum chem 131

1-Methods of expressing the concentrations of solutions

Chemical units - physical units - preparation of standard solutions

2-Acids and bases

1-2- PH calculations for strong acids and strong bases

2-2- PH calculations for weak acids and weak bases

3-2- Regulating solutions, their types and benefits, and calculating their PH

3-Hydrolysis of salts

1-3- Salts derived from a strong acid and a strong base

2-3- Salts derived from a strong acid and a weak base

3-3- Salts derived from a weak acid and a strong base

4-3- Salts derived from a weak acid and a weak base

4- Quantitative volumetric analysis (neutralization reactions)

1-4- Introduction to volumetric analysis

2-4- Evidence used in neutralization reactions and the principle of action

3-4- Alignment curves for strong acids and strong bases

4-4- Alignment curves for weak acids and strong bases

5-4- Alignment curves for weak acids and weak bases

7-4-4-- Differential straightening

5-Precipitation reactions

1-5- Mohr's method for determining halogens

2-5- Volhard method for determining halogens

3-5- Determination curves for precipitation reactions

6-Oxidation and reduction reactions

1-6- Balancing oxidation and reduction equations

2-6- Cells and their types

3-6- Nernst equation

4-6- Determination curves for oxidation and reduction reactions

7-Complex formation reactions

1-7- EDTA reactions with metals

2-7- Phatronic evidence

3-7- Calculations of the permanent and temporary hardness of drinking water Analysis of a mixture of sodium carbonate and sodium bicarbonate

4-7-Determination curves

Reference

1-Theoretical foundations of inorganic analytical chemistry (quantitative gravimetric and volumetric analysis), written by Abdul Karim Al-Shallal, Hadi Kazem, Jawad Salman, Saleh Muhammad

2- Foundations of Analytical Chemistry, translated by Zuhair Kassir, Edmund Mikhail, and Abdel Latif Abdel Razzaq.

Second Level

CHEM201 The elements represented in the periodic table, where the elements are studied, their existence, general characteristics, and interactions

Curriculum CHEM 201

1- Representative elements

Its location in the periodic table - periodic properties - ionization energy - electronic affinity - electronegativity - atomic radius - covalent radius - metallic properties

2-Hydrogen and hydrides

Its existence, general characteristics and interactions - hydrogen isotopes - its production in industry and its uses - hydrogen isomers (ortho and para hydrogen) - hydrides and their types and composition - hydrides of group elements

3-Alkaline elements

General characteristics - preparation - presence - halides - oxides - hydrides - sulfates - similarity between lithium and magnesium.

4-Alkaline earth elements

General characteristics - preparation - presence - halides - oxides - hydrides - similarity between beryllium and aluminum.

5-Boron and aluminum group

Introduction - their preparation and recipes - halides - oxides - alum - hydrides - complexes - nitrogenous compounds of boron

6-The carbon and silicon group

Elements and their characteristics - halides - carbides - oxides - hybridization - the

elements germanium, tin and lead - their characteristics, preparation, most important compounds and uses.

7-The oxygen and sulfur group (galcogens)

Characteristics of elements, their existence, and methods of obtaining them - their most important compounds - oxides, peroxides, and peroxides.

8-The group of halogens

Introduction - their existence - methods of separating them - their characteristics - halogen and oxyhalogen acids - their compounds

9-The group of noble gases

General characteristics - their components - their uses

10-Symmetry

The importance of symmetry in chemistry - symmetry processes - examples

Reference:

1-Comparative inorganic chemistry and structure, translated by Dr. Mahdi Naji Al-Zakum

2-Chemistry of the elements represented by Dr. Mahdi Naji Al-Zakum and Dr. Kazem Al-Obaidi

3- Basic inorganic chemistry (Part 1), translated by Dr. Mahdi Naji Al-Zakum

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CHEM202 / Coordination Chemistry:

Teaching the student the forms of complexes and their properties according to scientific theories.

Curriculum CHEM202

1-Introduction to transition elements

2-Introduction to the emergence of theories of interaction

3- Naming complex compounds

4-Crystal field theory

Cleavage of d orbitals for different coordination numbers - crystal field stabilization energy for high-spin and low-spin complexes

5-The theory of the valence bond - hybridization of atomic orbitals

6- Lycandian field theory

7-Molecular orbital theory

8-A comparison of the extent of success and shortcomings of association theories

9-Spectral and magnetic properties of complex compounds

10-Stereochemistry of complex compounds with coordination numbers 4 and 6

11-Preparation and reactions of complex compounds

12-Carbonyl compounds

Its preparation - reactions - properties

Reference:

1- Coordination Chemistry, written by Dr. Issam Girgis Saloumi

2-Chemistry of Transition Elements, written by Dr. Mahdi Naji Al-Zakum

3- Coordination Chemistry, written by Yaslow and Johnson, translated by Dr. Ali Falih Ajam

CHEM211 / Aliphatic Organic Chemistry:

Introducing students to the chemistry of hydrocarbons, especially aliphatic organic materials, and their derivatives such as alcohols, aldehydes, ketones, carboxylic acids, amines, and others.

Curriculum CHEM211

1-Structure and properties of the carbon atom

2-Alkanes - cyclic alkanes

3-Alkenes - naming

4-Alkynes - naming and geometric similarity

5- Dienes - their types - addition 1, 4

6-Alkyl halides

7-Alcohols

8-Ethers

9-Aldehydes and ketones

10-Carboxylic acids - acidic

11-Carboxylic acid derivatives - their effectiveness

Acid halides - anhydrides - esters - amides

12-Amines

The above vocabulary includes nomenclature - preparation methods - interactions

Reference :

1-Organic chemistry by Roberts Stewert and Casiro

2-Organic chemistry by Morrison and Boyed

3-Intensive introduction to organic chemistry, translated by Dr. Fadel Kammouna and Dr. Iqbal Al-Shaibani

4-Organic Chemistry, translated by Raad Al-Hamdani and Ismail Bassiouni

5-A comprehensive overview of organic chemistry, translated by Muhammad Nizar

6-Fundamentals of Organic Chemistry, written by Dr. Qais Atwan Sharif

CHEM212 / Aromatic Organic Chemistry:

The chemistry of organic compounds is crucial due to the variety of these compounds and they are found in plants, animals and crude oil. These compounds are used in many applications, such us drugs, paints, adhesives', so study the synthesis, reactions of these compounds give the student the knowledge how these compounds are produced biosynthetically or in the lab and their reactions which could be converted to another crucial compounds.

Curriculum CHEM212

1-Comparing benzene with alkenes - stability of aromatic benzene compounds

2- Chemistry of benzene and its derivatives - nomenclature - physical and chemical properties

3-Aromatic electrophilic compensation

Halogenation - sulfonation - nitrification - alkylation - acylation - directing compensation

4-Arenes

4-1- Chemistry of aryl halides

4-2- Chemistry of phenols and quinones

4-3- Chemistry of sulfonic and carboxylic acids

4-4- Chemistry of aldehydes, ketones, and alcohols

4-5- Chemistry of nitrogen compounds

4-6- Derivatives of aromatic compounds with a side chain

4-7- Chemistry of aromatic compounds with more than one benzene ring

4-8- Introduction to the chemistry of heterocyclic compounds

4-9- Acidic and basic aromatic organic compounds

Reference:

1-Organic chemistry by Roberts Stewert and Casiro

2-Organic chemistry by Morrison and Boyed

3-Aromatic chemistry by Warning

4-Intensive introduction to organic chemistry, translated by Fadel Kammouna and Iqbal Al-Shaibani

5-Organic Chemistry, translated by Raad Al-Hamdani and Ismail Bassiouni

6-A comprehensive overview of organic chemistry, translated by Muhammad Nizar

7-Fundamentals of Organic Chemistry, written by Qais Atwan Sharif

CHEM221 / Thermodynamics:

Study of the relations between heat, work, temperature, and energy. The laws of thermodynamics describe how the energy in a system changes and whether the system can perform useful work on its surroundings.

Curriculum CHEM221

First - the first law of dynamics

1. **Introduction - SI system of units - Properties of systems - Specific photodynamics –**
2. **Specific terms in photodynamics: standard state, dynamic system of light and its surroundings, state of the dynamic system of technology, variations of the system, thermodynamic functions.**

2- Experimental reversible and irreversible processes

3-Energy

4-Thermal energy - the work done in the processes of expansion and compression of ideal gases - chemical energy or internal energy

5-The zero law of thermodynamics

The first law of thermodynamics - isothermal and adiabatic processes - heat capacity of ideal gases - applications of the first law of thermodynamics - heat capacity - reversible and irreversible expansion and contraction processes Isothermic - reversible adiabatic expansion processes - Joule-Thomson coefficient - the relationship between enthalpy and internal energy

Second - Thermal chemistry

1-Introduction - the rapid reaction and the complete reaction - the pure reaction - the standard condition and the agreed upon signal

2- Heat of reaction

3-Laws of thermochemistry

Hess's law of constant addition - heat of formation - heat of solution - heat of exchange - heat of combustion - change of heat of reaction with temperature - energy of bonding - examples

Third: The second law of thermodynamics

Introduction and text of the law - Carton cycle - Carton cycle efficiency - Entropy changes for reversible and irreversible processes - Entropy changes for gaseous systems - Entropy changes for liquid and solid systems - Entropy change for a mixture of ideal gases –

Integration of the first and second laws of thermodynamics

Fourth, free energy

1- Introduction to deriving the free energy equation - dependence of free energy on pressure - free energy of chemical reaction - dependence of free energy on temperature: A- Gibbs equation B- Helmholtz equation C- Clapeyron equation D- Clausius-Clyburn equation

2-Chemical systems

Fundamental equations of closed systems - Maxwell's relations

3-Chemical potential

4-Molecular molar volumes

5-Free energy, measured free energy and its relationship to the equilibrium constant

6-Dependence of the equilibrium constant on temperature (van't Hoff equation)

7-Ideal and non-ideal solutions - Raoult's law - Collective properties (decrease in vapor pressure - decrease in freezing point - rise in boiling point - osmotic pressure)

Reference:

1-Physical Chemistry (Theoretical Foundations and Applications) written by Anis Abdul Wahab Al-Najjar - Mosul University Press - 1986

2-Physical Chemistry (Advanced Problems and Their Solutions), written by Anis Abdul Wahab Al-Najjar and Khaled Al-Ani - Basra University Press - 1980

3-Physical Chemistry - Written by Jalal Muhammad Saleh - Baghdad University Press - 1977

4-Physical chemistry, By Atkins - oxford press

CHEM222 / Electrochemistry:

Electrochemistry provides information on a number of phenomena such as the technology of metals and their corrosion, the cause of corrosion, direct study of electricity-generating cells, knowledge of how oxidation and reduction reactions occur.

Curriculum CHEM 222

1- Electrical connection

General introduction - metallic conduction and electrolytic conduction - types of electrical conduction - types of liquids - units used in electrochemistry - Faraday's laws for electrolysis - electrochemical equivalents - electrochemical reactions (comparison between molten salts and aqueous media)

3- Electrical conductivity measurements, specific resistance and Ohm's law - specific
4- conductivity - cell constant - equivalent conductivity and molar conductivity - direct current and alternating current - Wheatstone bridge

1- Electrical conductivity changes with concentration

Strong electrolytes (completely dissociated) and weak electrolytes (incompletely dissociated) - Kohlrasch equation - molar and equivalent conductivity at zero concentration - origin of the electrolytic theory (Arrhenus law - how to determine Λ in weak electrolytes - Kohlrasch's law for independent migration of ions - Ostwald's law of dilution

2- Ionic transition

Transition numbers (single solution and in the mixture) Measurement of transition numbers (1-Hetorf method 2-Moving limit method) Transitivity of both hydrogen and hydroxyl ions - Improving the model of ions in aqueous solutions (the role of the solvent and the dielectric constant) - Ionic effectiveness coefficients and their dependence on intensity Ionic solution - Debye's theory - structure and coefficient of effectiveness – electrical conduction theory - Voss-Onsaker equation - ionic assembly - Walden's rule – practical applications for measuring electrical conductivity (dissociation constants for weak acids and bases - hydrolysis constants - interpretations for measuring electrical conductivity) - the solubility of electrolytes is scarce. Solubility – the ionic yield of water

1- Electrochemical cells at equilibrium –

2- General introduction - The electrical double layer - Definition of the potential difference in the cell - The electric potential difference of galvanic cells - The electromotive force and cell interactions - Connecting the electrical circuit - The standard Weston cell and thermal coefficients - Types of half cells (electrodes) - Gas electrodes - Metal electrodes and their ions - Amalgam electrodes - - Oxidation and reduction electrodes - Non-gaseous, non-metallic electrodes - Electrodes of the metal and its insoluble salt such as (Ag/AgCl) and calomel electrode (Hg/Hg2Cl2) - Electrodes of the metal and its oxide, which is sparsely soluble.

1- Reversible cells

Changes in the free energy of cell reactions - electrode potential and how to calculate it – standard driving force for cells - dependence of E on the degree of concentration and activity - thermodynamic functions for the electrochemical cell - standard applications E (determination of standard electrode potentials - determination of effectiveness coefficients - determination of thermodynamic dissociation constants and dissolution quotients – Calculating the ionic quotient of water – pH measurements – Hydrogen electrode – Oxygen electrode – Quinone electrode – Glass electrode and its types – Stress corrections

2- Focus cells

Polarity and electrolytes with and without transition

1- Electrical cells when unbalanced

Irreversible cells and polarization - dissociation potential - above voltage (overvoltage) – cells with fixed electrodes - mechanics of processes occurring at the electrodes - specific current (diffusion current) - electrochemical corrosion (general introduction)

Reference:

1- Physical Chemistry (Theoretical Foundations and Applications), written by Anis Abdul Wahab Al-Najjar - Mosul University Press - 1986

2- Physical Chemistry (Advanced Problems and Their Solutions), written by Anis Abdul Wahab Al-Najjar and Khaled Al-Ani - Basra University Press - 1980

3- Physical Chemistry - written by Jalal Muhammad Saleh - Baghdad University Press - 1977

1. **Physical chemistry , By Atkins – oxford press**
2. **Physical chemistry , By Ira N Levine , McGraw Hill**

3- **Physical chemistry , By G W Castella , Addison-Wesly**
4- **Ions in solution (Introduction to electrochemistry) By J Robbin , Oxford university press**
5- **Advance physical chemistry calculation , By Averd and Shaw**
6- **Mathmatical preparation for physical chemistry , by Daniels**

CHEM242 Biochemistry: Identifying the biological structure and interactions of biological compounds.
Curriculum CHEM242
1-Carbohydrates
Chemical applications - application, photosynthetic activity and stereoisomers - important chemical reactions - mucous polysaccharides and their biological importance
2-Fats
Introduction and its chemical nature - classification and chemical properties - chemical reactions - industrial importance
3-Proteins
Introduction and chemical nature - the structural units of proteins - the formation of the peptide bond and the construction of the protein molecule - the important interactions of amino acids - protein classification - determining the sequence of amino acids in the routine molecule - the structural structure of proteins
-Nucleic acids
Their existence and chemical nature - the importance of nucleotides - the main components of amino acids - the chemical structure of nucleosides and nucleotides - the structure of nucleic acids, the structural unit and the main bonds - the chemical and enzymatic degradation of nucleic acids - the structural composition of the molecules of nucleic acids
5-Enzymes
The chemical nature of enzymes, the mechanism of action of enzymes - factors affecting the effectiveness of enzymes - enzyme activators - enzyme inhibitors, isoenzymes - regulatory enzymes

Reference:

Biochemistry, written by Qais Atwan and Issa Abdel Hussein Abdel

The third level

CHEM315 / Heterogeneous aromatic compounds

CH315 / Heterocyclic aromatic compound:
Familiarize students with the names and structures of heterocyclic aromatic compounds, as well as the methods of their preparation and their reactions because of their great importance, as this type of compounds enters into many aspects of life, such as the pharmaceutical industries.

Curriculum CHEM315

1- General introduction

2- Heterocyclic compounds similar to the cyclopentadiene ring containing a heteroatom

1-2- Pyrrole

2-2- Furan

3-2- Thiophene

3- Ring compounds similar to benzene containing a heteroatom: pyridine

4- Pentagonal compounds containing two heterogeneous atoms

1-4- Pyrazole

2-4- Imidazole

5- Cyclic compounds similar to naphthalene containing a heteroatom

1-5- Quinoline

2-5- Isoquinoline

6- Hexacyclic compounds containing two heterogeneous atoms: pyridazine

7- Cyclic compounds similar to naphthalene containing two heterogeneous atoms: cinolene

8- Cyclic compounds fused with the pyrrole ring, indole

Each chapter includes chemical and physical properties - preparation methods - reactions and presence

Reference:

1. **Introduction to the chemistry of heterocyclic compounds, translated by Dr. Fadel Kammouna and Dr. Iqbal Al-Shaibani**
2. **The chemistry of hetrocycles by Hans Suschitzky and Judith Suschitzky**

CHEM321 / Kinetic Chemistry:

The course aims to introducing to the student to the mechanism of reactions, calculating the rate of reactions and the extent of consumption of quantities of reactants with respect or time in terms of concentrations, volumes or pressures, especially for gaseous substances, determining the pathways of reactions, order of reactions, classification of reactions according to phases and molecularity, and how to calculate the energy accompanying the occurrence of the reaction, such as activation energy and thermodynamic functions that are related It has rates of rate of reactions. It is also possible to identify the catalysts and temperature and how these two factors affect the rate of the rate of reactions, in addition to studying various types of reactions.

Curriculum CHEM321

1- Kinetics of chemical reactions Overview - Classification of reactions according to (phase, molecular multiplicity, reaction order) - Definition of (degree of reaction - reaction rate, reaction rate constant, half-life)

2- Degrees of interaction

2-1- Zero degree reactions - Calculating the reaction rate - Reaction rate constant - Half life

2-2- First-order reactions - Calculating the reaction rate - Reaction rate constant - Half-life - First-order calculation in terms of (concentrations, volumes, pressure, absorption, conductivity, polarization angle, nuclear reactions)

2-3- Second-order reactions with similar and different concentrations - calculating the rate of reaction rate, reaction rate constant, half-life, special second-order reactions, migration reactions of the first order

2-4- Class III reactions (first, second and third) - Calculating the reaction rate - the reaction rate constant - half-life

2-5- n-degree reactions - Calculating the reaction rate - reaction rate constant - half-life

1- Methods of finding the degree of interaction

3-1- Method of changing proportions

3-2- Integration method or attempt - theoretical application - graphical methods

3-3- Half-life methods - the graphical method - the relationship between the half-life and the reaction rate - the practical method - the relationship between the half-life and the initial concentration

3-4- Differentiation method - theoretically - graphically

3-5- Initial rate method for complex reactions

3-6- Insulation method

1- Complex interactions

4-1- Opposite reactions, calculations of differential and integral equations (1^{st} X1^{st} $[B]_0=0$)

Set a value K_1 and K_{-1} From the slope as a function of concentrations and the equilibrium constant (1^{st} X1^{st} $[B]_0$= b) , (1^{st} X2^{nd}) , (2^{nd} X 1^{st}) (X2^{nd} 2^{nd})

4-2- Successive reactions, calculations of differential and complementary equations to calculate the concentrations of A, B, C and the time required for the highest concentration of B

4-3 - Parallel reactions of the first and second classes - calculations of differential and complementary equations to calculate the concentrations of A, B, and C for the two classes

4-4- Chain reactions - Calculating the reaction rate - Steady state hypothesis - Determining the reaction mechanism - Step method determining the reaction rate

1- The effect of temperature on the rate of reaction speed - activation energy - Arrhenius equation - Calculation of thermodynamic functions according to Arrhenius theory

2- Theories of reaction speed

1- 1- Collision theory - productive and non-productive collisions - calculating the total collision frequency (for one molecule, for different molecules, for similar molecules) - calculating the average speed of the molecule - calculating the effective part of collisions - calculating the reaction speed rate - calculating the reaction speed rate constant - calculating Frequency coefficient - calculation of activation energy - calculation of the vacuum obstruction coefficient.

2- -2- Effective complex theory - Calculating the reaction rate - Calculating the reaction rate constant - Calculating thermodynamic functions according to the effective complex theory - Calculating the frequency coefficient - Activation energy calculation - Calculating the reaction rate constant for solutions and gases - The difference between collision theory and collision theory Active complex

1- Factors affecting the reaction rate

7-1- The effect of the solvent - the dissolution process - the dielectric constant - the viscosity of the solvent

7-2- The effect of pressure on the reaction rate - the activation volume - calculating the reaction rate constant as a function of pressure

7-3- The effect of ionic strength on the reaction rate - Debye-Haeckel equation - ionic strength - the main effect of the salt - the Bronsted-Grim equation - the secondary effect of the salt

1- Rapid reactions

8-1- Flow methods - Contact methods - Constant flow method - Moving flow method -

8-2- The relaxation method - derivations of the relaxation time

9- Auxiliary factors

Homogeneous cofactors - Heterogeneous cofactors - Specific catalysis - General catalysis - Enzymes as catalytic agents - Michaelis constant

Reference:

1- **Physical Chemistry (Advanced Problems and Their Solutions), written by Anis Abdul Wahab Al-Najjar and Khaled Al-Ani - Basra University Press - 1980**
2- **Principles of the speed of chemical reactions, written by Ali Abdul Hussein Saeed**
3- **Kinetic and Electrical Chemistry, written by Ahmed Hashem Al-Dabbagh and Banan Aqrawi**
4- **Physical chemistry , By Atkins – oxford press**
5- **Physical chemistry by Moore , Logman 1962**
6- **Elementary reaction kinetic by latham**

CHEM324 / Chemistry of Molecular Spectroscopy: Definition of Bermian electron resonance - Theory - Origin of the ESR signal - Zeeman effect - g factor - Ultrafine coupling - Glass solutions - Relative intensity and number of bands - Bermian electron resonance spectra of free radicals - Bermian electron resonance spectra of transition elements - Uses And applications. Masbauer spectroscopy, Masbauer effect - isotope displacement - nuclear quadrupole pairing - supermicromagnetic mutual influence - applications

Curriculum CHEM324

1- Introduction

Electromagnetic radiation - quantization of energy - Schrödenker equation, regions of the spectrum - width and intensity of electronic transitions - basic components of the spectrum

2- Microwave spectroscopy

Rotation of molecules - rotation spectra - rotation spectra of diatomic molecules - rigid rotor - isotope compensation effects - non-rigid rotor - intensity of spectral lines - rotation spectra of polyatomic molecules - applications

3- Infrared spectroscopy

Vibration of diatomic molecules - vibration spectra of diatomic molecules - harmonic oscillator - inharmonic oscillator - rotational vibration of diatomic molecules - inertia of the Born-Oppenheimer approximation - vibration of polyatomic molecules – applications

1- Ultraviolet and visible spectroscopy

Principles of electronic spectroscopy - spectra of diatomic molecules - spectra of polyatomic molecules - charge transfer spectra - d-d transitions - applications

2- Nuclear magnetic resonance spectroscopy

Magnetic properties of nuclei - Zeeman mutual effect - resonance conditions - chemical displacement - spin-spin coupling - analysis of nuclear magnetic resonance spectra - applications

3- Permian electron resonance spectroscopy

Magnetic properties of the electron - the mutual Zeeman effect - resonance conditions - the G-factor - ultrafine coupling - the Permian electronic resonance of free radicals - the Permian electronic resonance factor for the elements

1- MASPAR spectroscopy

2- Probe effect - Isotope displacement - Nuclear quadrupole pairing - Mutual influence over magnetic fineness - Applications

Reference:

1- Fundamentals of molecular spectroscopy by Banwell

2- Magnetic resonance by McLauchlan

3- Physical chemistry by Atkins

4- Spectrochemistry, written by Dr. Layla

5- Physics (Advanced Problems and Their Solutions), written by Anis Abdul Wahab Al-Najjar and Khaled Al-Ani - Basra University Press – 1980

CHEM342 / Metabolic Biochemistry: Identifying the metabolic reactions of biological compounds and what their metabolites are. How to regulate metabolic reactions.

Curriculum CHEM 342
1- Vitamins (composition and classification) Fat-soluble vitamins - water-soluble vitamins
2- Hormone Chemistry Thyroid hormone - pancreatic hormone (insulin and cocaine) - adrenaline hormone -
3- Biological Oxidation Enzymes accompanying redox reactions - high-energy compounds in biological oxidation - foundations and laws in energy production
4- Metabolism of carbohydrates - Anaerobic oxidation (glycolysis) - building and breaking down glycogen - aerobic oxidation (Kreb's cycle and tricarboxylic acid cycle) - pentosephosphate sugar cycle - preparing or building glucose from non-carbohydrate sources
5- Fat Metabolism Fatty compounds circulating in the blood - fat oxidation - fat biosynthesis - metabolism of unsaturated fatty acids - ketone bodies
6- Metabolism of proteins Nitrogen balance - catabolism of amino acids - breakdown of the carbon skeleton of amino acids - urea cycle - biosynthesis of amino acids - biosynthesis of proteins

Reference:
1- Biochemistry, written by Issa Abd and Qais Al-Kilani
2- Text book of biochemistry by West and Todd

CHEM343/Clinical Biochemistry: Objectives: To introduce the student to clinical biotechnology and how to deal with analysis models conducted in medical laboratories.

Curriculum CHEM343
1- Introduction to clinical biochemistry
Definition of clinical chemistry - Why do we study clinical chemistry - Collecting and preserving samples (blood - urine - stool) - Factors that must be taken into consideration before collecting samples - Factors that are taken into consideration at the time of collecting samples - Changes that may occur in blood and urine samples after collection
1- Carbohydrate metabolism:
Controlling glucose metabolism (insulin, glucose, and other hormones) - measuring the level of glucose in the blood and urine - diabetes, its classification and types - diabetes and ketone bodies - abnormal metabolism in the liver during diabetes - low blood glucose level
2- Fat metabolism:
Introduction - Cholesterol - Triglycerides - Phosphorous lipids - Fatty acids - Cholesterol metabolism - Disorders in fat metabolism - Lipoprotein - Obesity - Atherosclerosis, Angina pectoris and heart attack
3- Metabolism of proteins:
Plasma proteins - chemical and physical methods for measuring proteins - immunological methods for measuring proteins - diseases resulting from changes in

the concentration of plasma proteins - aminoglobulins (their composition and classification) - disorders of aminoglobulin formation - disorders of protein metabolism
4- Hormones:
Mechanism of hormone action - thyroid hormones and their concentration in plasma – effects of increased or decreased thyroid secretions - growth hormones

Reference:
1- **Biochemistry, written by Issa Abd and Qais Atwan**

CHEM351 / Principles of Industrial Chemistry:

Industrial Chemistry is an undergraduate Chemistry course. Industrial Chemistry is the process of development, optimization, and monitoring of fundamental chemical processes used in industry for transforming raw materials and precursors into useful commercial products for society. Industrial Chemistry program provides a broad education within chemistry.

Curriculum CHEM351
1- Foundations and economics of chemical manufacturing processes
Factors affecting capital costs - Factors affecting production costs
2- Types of chemical manufacturing processes
Continuous industrial processes - industrial processes with meal
3- Intermittent process reactors
Gaseous – liquid, liquid – solid, gaseous – solid, including the presence of homogeneous auxiliary factors, including the presence of heterogeneous auxiliary factors - production and transformation outcomes
3- **Flow curves for industrial processes**
4- **Matter balance**
5- **Chemical corrosion and ways to prevent it**
6- **Types of corrosion - theories of corrosion - factors affecting corrosion - corrosion prevention - membrane prevention - chemical prevention - electrochemical prevention - corrosion tests and methods of reducing corrosion**
7- **Industrial pollution**
8- **Industrial water pollution - types of industrial water pollutants - wastewater treatment processes**
9- **Industrial air pollution and methods of treating it**
10- **Water treatment for industrial purposes**
11- **Sources of water for industry and the quality of water used in industry - Methods of water treatment in industry**

Reference:
1- **Industrial Chemistry, written by Korkis Abdul Adam**
2- **Foundations of industrial chemistry written by Aziz Ahmed**

CHEM352/Polymer Chemistry:

This course provides an opportunity to learn general aspects of synthetic polymer chemistry as well as to study step-growth polymerization (Condensation), and chain polymerization (Addition), and polymer reaction. This course covers not only the basic aspects but also advanced topical researches and applications of polymers in materials science.

Curriculum CHEM352

Chapter One:

1. **General introduction - what is meant by polymer - history of polymer science - sources of polymers - natural polymers - prepared polymers.**
2. **Naming of polymers-**

Simple nematic polymers - Nomenclature of polymers resulting from condensation or addition - Nomenclature of condensation polymers - Nomenclature of copolymers - Nomenclature of randomly formed copolymers - Nomenclature of alternating copolymers - Nomenclature of grafted copolymers - Nomenclature of agglomerated (template) copolymers - General and commercial nomenclature - Chemical nomenclature According to the International Nomenclature System (IUPAC):

3. **Factors determining polymer properties**

Molecular weight of the polymer - nature of the molecular chain of the polymer - molecular forces

Chapter Tow:

1- Types of polymers and their classification

a. Inorganic polymers b. Organic polymers c. Technological classification of polymers

1. Heat-resistant polymers (plastics) 2. Thermosetting polymers 3. Fibers 4. Flexible polymers (rubber)

2- Classification of polymers based on the reactions leading to their formation

a. Old classification (addition polymers and condensation polymers) b. Modern classification: [1. Sequential growth polymerization (free radical polymerization, cationic polymerization, anionic polymerization, coordination polymerization) 2. Step polymerization [

Chapter III

Polymerization processes and conditions

A. **Homogeneous polymerization: 1. Block polymerization 2. Solution polymerization**

B. Heterogeneous polymerization: 1. Polymerization in plankton 2. Polymerization in emulsions 3. Polymerization between surfaces of a solution 4. Polymerization in the gas phase 5. Precipitation polymerization

the fourth chapter

Important industrial polymers with step growth

- Polyesters - General introduction: A. Aliphatic filamentous polyesters b. Filamentous aromatic polyesters c. Branched and cross-linked polyesters d. Polyesters are non-carboxylic acids

Polyamides - Polyurea - Polyurethane - Phenol formaldehyde resins (Resol and Novolac) - Urea formaldehyde resins - Melamine formaldehyde resins

Chapter V

Properties of polymers, their diagnosis and analysis - Physical properties of polymers: 1. Crystallinity and melting point 2. The glass state and the degree of glass transition

CHEM353 / Petroleum Chemistry: The course aims to provide students and students with information about crude oil and its derivatives, methods for evaluating the qualitative characteristics of oil and its derivatives, and what are the most prominent chemical and physical processes that take place in refineries to produce the petroleum derivatives required in the markets, then knowledge of all types of petroleum products and their additives.

Curriculum CHEM353

1- Oil

Introduction - Theories of oil formation - Chemical composition of oil

2- Chemical processes in oil refining

Thermal solution - catalytic thermal solution - hydrogenation solution - catalytic polymerization - catalytic alkylation - catalytic isomerization - gasoline synthesis transformation

3- Composition of crude oil and its derivatives

Specific gravity - viscosity - flash point - fire point - combustion degree - volatility - aniline degree - ash content - atomization - cetane count and cetane coefficient - clouding degree - doctor's examination - distillation degree - octane number - penetration number - spillage degree

4- Refinery products

Low boiling point products - gasoline - naphtha and kerosene - diesel fuel - heating oils - diesel engine fuel

5- Petroleum classification

6- Crude oil processors

7- Petroleum filtration

Distillation of all kinds - extraction with solvents - absorption and stripping - absorption and adsorption

Reference:

1- Industrial Chemistry, written by Kurkess Abdul Adam

3- Oil Chemistry, written by Samir Salim Al-Qass

CHEM313 Stereochemistry

The curriculum

Polarized light - and the property of rotation of polarized light - stereoisomers - chirality of bodies and molecules - isotropy - opposites - Fisher's projections - the nomenclature system R and S - apymers - meso compounds - racemic mixture - specific rotation - isolation of isotropy - atrope isomerism

Mechanics of organic reactions

1- Factors affecting the abundance of electrons in bonds and atoms

Inductive effect - mesomeric effect - supra-sequence effect - vacuum effect - the relative importance of resonant structures

2- Kinetics and thermodynamics of the reaction

Reaction energy - reaction kinetics - kinetics and the step determining the reaction rate and factors affecting the speed of its formation (solvent - composition of the starting material - auxiliary factors) - competing kinetic and thermodynamic control of the reaction with various examples of this.

3- Compensatory nucleophilic reactions on the saturated carbon atom

Detailed description of the mechanics of SN1 and SN2 - Factors affecting SN1 and SN2:-

The effect of the solvent - the effect of the composition - the stereochemistry of the mechanics of SN1 and SN2 - determining the relative order of the mechanical products of SN2 - the nature of the mechanical products of SN1

4- Mechanical internal compensation SN1

5- Mechanism of neighboring group participation

For the alkaline hydrolysis of betachlorohydrin - Alkaline hydrolysis of carboxylic acids substituted with a halogen in the alpha position - Hydrolysis of sulfuric and nitrogenous ethers substituted with a halogen in the beta position

6- The effects of internal and departing groups on the speed and mechanics of SN1 and SN2 reactions

7- Epoxide ring opening reactions

Anionic nucleophilic opening of the epoxide ring - Acid-catalyzed opening of the epoxide ring

8- Various examples of nucleophilic substitution reactions on a saturated carbon atom that do not include hydrolysis or alkaline hydrolysis.

9- Methods of forming carbonium ions

Direct ionization - protonation - dissociation

10- Carbonium ion stability

11- Mechanism of rearrangement reactions of the carbonium ion and the carbon, nitrogen, and oxygen atoms that are charged with electrons

The main types of carbonium ion reactions - allylic rearrangement - Vancker-Mrouin rearrangement (neopental rearrangement) - pinacol-pinacolline rearrangement - Beckman rearrangement - Wolff rearrangement and Arendt-Eicherite reaction - Bayer-Felcker rearrangement - peroxide rearrangement

12- Addition reactions to the carbon-oxygen double bond

Introduction to the effectiveness of the carbon-oxygen double bond - structure and effectiveness

13- Compensatory reactions on the acylated carbon atom

Comparison of the effectiveness of the acyl carbon atom in carboxylic acids and their derivatives against nucleophilic reagents - basicly catalyzed reactions - alkaline hydrolysis of esters - alkaline hydrolysis of amides - reaction of amines with esters and the reaction of replacing the alcoholic part of the ester: acid-catalyzed reactions - hydrolysis - reaction with alcohols - reaction with the hydride ion

14- Nitrile addition reactions

15- Deletion reactions (double bond formation)

A general introduction to the types of base- and acid-catalyzed deletion reactions and the dissociation of quaternary amines by replacing them with alkyl groups - the mechanism of the monomolecular deletion reaction E1

Reference

1-Organic chemistry of macromolecules by Robert Caziro

2-Organic chemistry by Francis Cary

3-Organic chemistry by Morrison and Boyd

4-A guide book of organic chemistry by Peter Sykes

5-Text book of organic chemistry by Arun Bahl and B S Bahl

6-Essential of organic chemistry by Boxer

An intensive introduction to organic chemistry, translated by Fadel Kammouna

7- Advanced Organic Organic Chemistry, written by Fahd Ali Hussein

CHEM314 Mechanics of Chemical Reactions

Curriculum

First - the carbinion

1- Structure and stability of carbenion

2- The acidity of hydrogen A

3- The so-called carbenium reactions

Condensation of states - Perkin-Stop - Claessen condensation of esters - Repharmastexy - Benzoin - Rearrangement of benzyllic acid Mannach - Method of preparing acetoacetic ester - Method of preparing malonic ester - Preparation of betadactone - Reimer.Temen - Kolb.Schmidt - Reactions of unsaturated carbonyl compounds at the two α sites And β - Michael reaction - Robinson coalescence - FTG reaction

Second: Cycloaliphatic chemistry

1- Classification of aliphatic cyclic compounds

2- Introduction to cyclic structure and its stability

3- The different structures of cyclic compounds and their stability

Cyclopropane - Cyclobutane - Cyclopentane - Cyclohexane - Cycloheptane - Cyclooctane

4- A brief overview of cycloalkenes

5- The shape of the chair and the boat

6- Body balance in cyclohexane, mono-substituted cyclohexane, and di-substituted cyclohexane with a methyl group using Newman projections in the analysis

1. **Combined cyclic aliphatic molecules (decalin and hydrindan) and studying their different structures**
2. **Boat-containing cyclohexane compositions**
3. **Body's relationship to reaction speed**
4. **Basic hydrolysis - acetolysis - oxidation - deletion -**
5. **The effect of ring size on the effectiveness of the compensation group**
6. **Compensation reactions - cation - cyclobutyl and cyclopropyl - reduction of cycloalkanes - activity of cycloalkenes**
7. **Cross-loop interactions**
8. **Different methods for preparing aliphatic cyclic compounds**
9. **Preparation of substituted cyclopropane - substituted cyclobutane - Diels.Alder reaction - Duckman reaction**
10. **Important interactions of cyclopropane and cyclobutane**
11. **Bridge rings**
12. **Introduction - Preparation of some compounds: 1. The method of acylone condensation 2. Acetols followed by closing the ring 3. Diels-Alder reaction 4. Bridge ring reactions ((dissolution in acetic acid - substitution reactions at the bridge head - deletion and cold base reactions - homoallelic participation))**
13. **Mechanism of E2 double-stranded deletion**
14. **Stereospecificity of the E2 mechanism - Site selectivity in the E2 mechanism - Competition between the mechanics of nucleophilic substitution and deletion - The mechanism of deletion of the bromine molecule - The mechanism of base-catalyzed deletion from the conjugate base E1CB - The mechanism of deletion from E1 (the Chagoff reaction) - The mechanism of alpha deletion**

Reference:

1- Elements of stereo chemistry by E Eliel , New York , 1969
2- A Guide book to mechanism in organic chemistry by P Sykes
3- Advance organic chemistry by Cary and Sundberg
4- A guide to the mechanics of organic reactions, translated by Fadel Kammouna

fourth level

CHEM401 / Chemistry of Transition Elements:

Study transition metals series and methods of extraction, characterizations and application

1- Introduction to the chemistry of the three transition elements

1-1- Periodic properties: electronic arrangement - melting and boiling points - atomization - ionization potential - electronic affinity

1-2- Oxidative states: Oxidative numbers for common and uncommon states - oxidation-reduction potential - electrode potential

2- Chemistry of the first transition chain

2-1- Their presence in nature - estimation and methods of extraction and purification - extraction and purification of iron, copper and zinc

2-2- Its compounds and preparation

2-3- Its complexes and preparation

2-4- Its interactions

3- Diagnosis of transition metal complexes

3-1- The importance of its diagnosis

3-2- Analytical and physical methods - precise elemental analysis - electrical conductivity methods - qualitative and quantitative analysis - determination of isomers

3-3- Spectroscopic methods - Visible and ultraviolet radiation - Infrared radiation - Mass spectrum - X-rays - Nuclear magnetic resonance - Permian electron resonance - Photoactivation

4- Stability of transition metal complexes

4-1- Kinetic stability - inactive and active complexes

4-2- Thermodynamic stability

4-3- Factors affecting stability - the effect of the metal ion - ligand and other factors

5- Transitional elements as motivating factors - an overview

Reference:

1- Chemistry of transition elements Dr. Mahdi Naji Al-Zakum

2- Coordination Chemistry Dr. Issam Girgis Saloumi

CHEM402 / Selected Topics: Inorganic Nano Chemistry:

Introducing the student to the concepts of inorganic nanomaterials because of their scientific importance, especially as we live in the nano era.

Or the mechanics of inorganic reactions. Number of semester units: 3

Curriculum chem 402

1- The nature and quality of the mechanics

1-1- Structural information

1-2- Reaction kinetics

1-3- Stability and idle / speed rate and mechanics

1-4- The extent to which the speed rate and the speed rate constant depend on the concentration and nature of the reactants

1. **Inorganic reaction mechanism by Tobe**
2. **Mechanism of inorganic reaction . A study of metal complex in solution by F Basalo and R G Person**
3. **Mechanism of inorganic reactions in solution an introduction by D Benson**

2- Compensation reactions for both

2-1- Octahedral complexes

2-2- Tetrahedral complexes

2-3- Planar quadrilateral complexes

3- Oxidation and reduction reactions

3-1- Electronic transmission

3-2- Reactions outside the symmetry sphere / reactions inside the symmetry sphere

3-3- Complementary reactions and non-complementary reactions

3-4- Oxidative addition reactions

3-5- Oxidative compensation reactions

4- Catalytic reactions

5- Hydrogenation of alkene

6- Polymerization of alkanes and alkenes

7- Hydroformylation reactions

Reference:

1- An Introduction to Inorganic Physical Chemistry, written by Harvey and Booker, translated by Dr. Issam Girgis Saloumi

2-Coordination chemistry translated by Dr. Ali Al-Tayyar and Dr. Ali Ajam

CHEM403 / Chemistry of non- aqueous solution:

The course aims at multiple concepts. Where the curriculum deals with topics, including those related to anhydrous solvents, their role in chemical reactions, and the characteristics of each solvent and its type. The curriculum also includes an explanation of the acids and bases in anhydrous solvents and how to measure their strength. The curriculum also touches on an important topic in chemistry and related to the stability of the reacting compounds and the products expected theoretically after the reactions were conducted. The so-called hard and soft acids and bases, in detail for all inorganic reactions

CHEM403 Curriculum:

1- **Chemistry in non-aqueous solvent**

   Common non-aqueous solvents , Amphoteric behavior, the coordination model , chemistry in liquid ammonia , ammunition reaction , ammonolysis reaction , metathesis reaction , acid-base reaction , metal-ammonia solution , liquid hydrogen fluoride , liquid sulfur dioxide , chemistry in ethanoic acid , liquid dinitrogen tetraoxide N_2O_4

2- **Acid base chemistry**

   History, Major Acid , Base concepts , Arrhenius concepts, Bronsted-lowry concept , solvent system concept, Lewis concept, Frontier Orbitals and acid-base reactions , Hydrogen bonding , Electronic spectra (Including charge transfer)

3- **Hard and soft acids and bases**

   Theory of hard and soft acids and bases , Quantitative mechanism

4- **Acids and bases strength**

   Measurement of acid base interactions , thermodynamic measurements , proton affinity , acidity and bascity of binary hydrogen compounds , inductive effects , strength of oxy-acids , acidity of cations in aqueous solution , steric effects ,

solvation and acid-base strength , non-aqueous solvent and acid base strength , super acids

5- Polyoxo compounds formation

Polymerization of aqua ions to polycataions , ploy oxoanions , Hetrogeneous acid-base reaction

References

1- G. L Missler and D A Tarr " Inorganic chemistry " 3rd edition

2- D F Shiver , P Atkins and C H Langford 2nd edition " Inorganic chemistry". chapter 5

CHEM416 / Identification of organic compounds:
Identification of organic compounds by spectroscopic techniques, by IR ,HNMR, UV-Visble.

Curriculum CHEM416:

1- Visible and ultraviolet spectroscopy

1-1- An introduction to electronic absorptions and their types

1-2- Simple chromophore groups, types of spectral shifts, and changes in absorption intensity

1-3- Experimental rules for estimating the locations of absorptions

1-3-1-Butadiene, similar to:

1-3-2- Cyclic dienes

1-4- Carbonyl chromophores and the effect of the solvent

1-5- Absorptions of the uncompensated benzene ring and the effect of compensation on absorption and the effect of the solvent

2- Infrared spectroscopy

2-1- Different vibrations of molecular bonds

hook

2-3- Aharmonic and above-pitched vibration

2-4- Exchange of dual action of vibrations

2-5- Representation of infrared spectra

2-6- The relationship of absorption intensity to dipole moment

2-7- The relationship of the joint angle to the verb alternation of the type “matt” - “matt.”

2-8- Interchangeable verb type: curvature - curvature

2-9- Interchangeable verb type: bending - stretching

2-10- A comprehensive survey of the sites of vibrational absorption of the bonds of the main types of organic compounds and interpretation of their spectra.

3- NMR spectroscopy of protons

3-1- Introduction

3-2- Chemical displacement

3-2-1- Definition of chemical displacement, measurement of displacement, and its relationship to frequency and field strength

3-2-2- Factors affecting chemical displacement

3-2-3- Diamagnetic shielding (induction effect)

3-2-4- The lysotropic effect

3-2-5- Paramagnetic effect

3-2-6- Vanderwaals effect

3-3- Twist-twist pair (first degree approximation)

3-3-1- Definition of the phenomenon

3-3-2- Interpretation of twirl-twirl fission

3-3-3- The duplication constant and the simple fission pattern

3-3-4- Rules for guessing the fission pattern

3-3-5- Physical effects on the twist-twist pair

3-3-6- The phenomenon of exchange

3-3-7- The phenomenon of electric quadrupole moment

3-3-8- A review of the different proton absorption sites and their interpretations

3-3-9- Integration and calculating the number of protons

3-4- Double twist - twist (second degree approximation)

3-4-1- Chemical valence and magnetic valence

3-4-2- Proton coding

3-4-3- Complex systems of spin-twist fission patterns

3-4-3-1- The AB system, calculating the displacement and the coupling constant

3-4-3-2- A descriptive presentation of different types of second-order systems AB2, ABX, AAXX, ABC, A2B2C3.

3-5- Replaced gasoline

3-5-1- Allelic duplications

3-5-2- Pairs between neighboring protons

3-5-3- Pairs between twin protons

3-6- Neutral and diastereomeric protons

3-7- Methods of simplifying spectra

3-7-1- Increase the intensity of the magnetic field

3-7-2- Replacement with deuterium

3-7-3- Irradiation to break the duplication

3-7-4- Changing the solvent

3-7-5- Use of displacement detectors

4- Mass spectrometry

4-1- Introduction

4-2- Mass spectrometer

4-3- Some important rules

4-3-1- Nitrogen base

4-3-2- The rule of even electrons

4-4- Relative abundance of some elements

4-5- Calculating the number of carbon atoms

4-6- Calculate the molecular formula

4-7- The semi-stable peak

4-8- Ionization and various fission of chemical bonds

4-9- Rules of partitioning

4-10- Interpreting the distinctive bands of the main organic compound classes

Reference:

1- **Spectral analysis of organic compounds, written by Sohaila Taleb**
2- **Spectroscopic methods in organic chemistry, translated by George JonathanSpectrometric Identification of organic compounds by Silverstein**
3- **Application of absorption spectroscopy of organic compounds by Dyer**

CHEM426 / Radiological and Nuclear:

The student's knowledge of what nuclear chemistry is, its difference from general chemistry, the difference between unstable and stable radioactive elements, the types of radiation that are emitted from them, and how to protect living organisms from radiation and its applications in the medical and industrial fields and in the field of manufacturing nuclear weapons

Curriculum CHEM426:

1- Introduction

The origin and structure of the atomic theory - the structure and construction of the atom - the structure of the nucleus, its mass and size

2- Nuclear types

Nuclear properties - forces between nuclei - meson theory - elementary nuclear particles

3- Introduction to radiochemistry

Radioactive elements and their types and subspecies - radiation and its types - radiation and its physical and chemical effects

4- Ionizing radiation

Alpha rays - beta rays - gamma rays

5- Nuclear decay

Laws of nuclear decay - measuring nuclear decay - diagrams of nuclear decay

6- Half life

Methods for measuring half-life

7- Average age

Radiation balance

8- Nuclear accelerators and their types

9- Nuclear reactors and their types

10- Nuclear fuel and its types

Methods of nuclear fuel enrichment - moderators - control electrodes - cooling medium - protective covers

11- Fast neutron reactors

12- Nuclear reactions

Nuclear fission - nuclear fusion

13- Energy sources in nuclear reactors

14- Devices used to measure x-rays

15- Units of radiation measurement

Authorized doses - biological effects - radiation protection

16- Applications in analytical chemistry

Foundations of activation analysis - areas of use of activation analysis - analysis by isotopic investigation

17- Radioactive isotopes in physical chemistry

18- Study of the mechanics of chemical reactions

Diagnosis of fission sites - chemical bonds

Reference:

1- Radiological and nuclear chemistry, written by Majeed Al-Qaisi

2- Radiochemistry, written by Ali Abdel Hussein Saeed

3- Nuclear Chemistry, written by Issam Girgis

CHEM427 Selective Topics in Physical Chemistry:
The course covers the topic of Liquid Crystals. We aim to understand the main basic concepts of liquid crystals, the fundamentals and chemical aspects of different types of liquid crystals(thermotropic and lyotropic) , and especially leading to an identification of the most important liquid crystal phases . On the other hand we slightly focus on physics concepts and optical properties of LC materials in order to understand the structure and function of liquid crystal displays and devices. Finally, we focus on key aspects related to the use of LCs in pharmacological and medical.

Curriculum CHEM427

1- Introduction - Definition of corrosion and the causes of its occurrence

2- The purpose of studying corrosion

3- Factors affecting corrosion

4- Solution chemistry for corrosion

5- Important terms related to corrosion

6- Types of erosion cells

7- Methods of treating corrosion

Cathodic protection - anodic protection

8- Types of corrosion inhibitors

Organic inhibitors - inorganic inhibitors - paint

9- Methods of measuring corrosion

Weight loss methods - the polar method

Reference

1- H Uhling " corrosion and corrosion control " , 1985

2- N Perez " Electrochemistry and corrosion science " , 2004

3- D Talbot and J Jalbout " Corrosion science and technology " , 1998

4- V A Goldade " Plastic for corrosion inhibitors " , 2005

5- P R Roberge " Hand book of corrosion engineering " 1999

6- Modern papers about corrosion from the net

CHEM431 / Instrumental analysis chemistry:
This course included principal spectroscopic method such as UV-Vis, IR , AAS and fluorescence methods in details , this course also included practice part for studying the determination of deferent analyses by instrumental methods

Curriculum chem 431

1- Introduction - Photometric analysis methods

1-1- Types of automated analysis methods

1-2- The electromagnetic spectrum - the wave and particle nature of the electromagnetic beam - absorption of radiation - types of transitions

1-3- Chromotoro and oxochrome - red shift - blue shift - charge transfer absorption bands

2- Devices used in optical analysis

2-1- Sources used in the ultraviolet - visible and infrared region

2-2- Reagents - Voltaic cell - Photocell - Photomultiplier -

2-3- Filters and separators (chromators) - filters - absorption filters - color units - diffraction 3- Absorption of ultraviolet and visible rays

3-1- Laws of radiation absorption

3-2- Bert-Lambert's law - Absorption constant - Deviation from Bert's law - Device factors - Chemical factors

3-3- Devices used to measure visible and ultraviolet radiation -

3-4- Applications

3-5- Mixture analysis - point of symmetry - molar ratio method - constant variation method

4- Fluorescence and phosphorescence

4-1- Introduction

4-2- The theory of fluorescence and phosphorescence - the relationship of concentration with the intensity of fluorescence

4-3- Extinction

4-4- Devices used and applications

5- Infrared rays

5-1- Preparing the solid model for measurements - gases - liquids

5-2- Quantitative analysis

5-3- Equipment used grating – prisms

6- Flame atomic emission and absorption spectrum

6-1- Introduction

6-2- Types of flame and measuring flame temperature - gas velocity

6-3- Stoves - types of stoves - advantages and disadvantages

6-4- Processes that occur in flames

6-5- Methods of entering the model – solid-liquid

6-6- Interactions

6-7- Non-flammable atomic absorption

6-8- Atomic emission spectroscopy in inductively coupled plasma - Advantages of emission plasma - Using plasma as a medium for ablation - Using plasma in atomic telephoresis

6-9- Atomic fluorescence - Types of flame atomic fluorescence - Devices used - Interventions

6-10- Devices used in technology

Reference

1- Fundamentals of Instrumental Analysis, Part 2, Zuhair Matta Kassir

2- Instrumental method of chemical analysis G W Ewing

CHEM444 / Selected Topics in Biochemistry:

Teaching this course aims to present some important topics in the field of biochemistry, which explain the relationship of chemistry to the functions of body and to clarify the chemical variables that occur inside the body.

Curriculum CHEM444

Techniques for separation and isolation of large biomolecules

1- Paper and thin layer chromatography

1-1- Rules and basics of chromatography

1-2- What is paper chromatography?

1-3- Mobile phase and liquid flow

1-4- What is the thin layer?

1-5- Mechanics of work and how to prepare sheets

1-6- Applications of paper and thin-plate chromatography

2- Electrical migration

2-1- Basics of electrical relay and work theory

2-2- Logical electrical relay

2-3- Free electrophoresis

2-4- Factors affecting the separation process

2-5- Applications of electromigration

3- Gel filtration

3-1- Types of gels, the most used and common

3-2- The process of swelling and filling the column

3-3- Mechanism of separation and distribution of media inside and outside the gel

3-4- Quantitative estimation of models

3-5- Applications of gel filtration chromatography

4- Liquid chromatography

4-1- High performance liquid chromatography

4-2- The basics of this technology

4-3- Why and for whom is this technology used?

4-4- Reversed phase chromatography

5- Gas chromatography

5-1- The carrier gas, its specifications and features

5-2- Types of columns used

5-3- Detectors used to sense isolated materials

6- Ion exchange chromatography

6-1- Types of resins used

6-2- Method of separation and isolation of models

7- Extraction and purification of large biological molecules using laboratory methods for the purpose of isolating and separating them

Reference

1- Separation of Biological Macromolecules By Gaal & Vereczkey

2- Macromolecules by Elias

CHEM455 / Polymer Processing:
The aim of this Course included the definition of polymer processing (convert the final polymers to final products through the processing under molding compression or extrusion) and then study of some mechanical properties of polymers like tensile strength, impact strength and thermal study.

1- Introduction to the classification of polymers from a technological perspective

Plastics (thermoplastics) - thermosetting resins - rubber polymer fibers - polymeric compositions - polymeric mixtures - polymeric alloys - IPN polymers

2- Rheological properties of polymers - factors affecting them - how to adopt these properties in the manufacture of polymers

3- Polymer manufacturing techniques - all kinds of molding - extrusion - injection - vacuum forming - casting - polishing

4- Templates used in the manufacture of polymers - studying the relationship between the geometric design of the template and the molecular orientation of the polymeric chainsear idea of the polymer before using it in the place designated for it.

5- The molecular orientation of the polymer chains and its distribution in the mold and how to control the molecular orientation - the orientation parallel to the pulling axis - the orientation perpendicular to the pulling axis - the dual orientation of the axes

6- Mechanical properties of polymers and factors affecting them - structural factors and external factors such as temperature, pressure and humidity - additives

7- Devices and techniques used to measure and evaluate mechanical properties

Tensile strength - impact strength - modulus of elasticity - coefficient of dynamic loss - coefficient of slip - relaxation

8- Identification of industrial and commercial polymers with the aim of benefiting from remanufacturing and reducing pollution

Reference

1- Polymer chemistry and technology
2- Kurkis Abdul Adam and Hussein Kashif Al-Ghita

CHEM456 / / Industrial Chemical Additives:
The Additives added to the food and lubricants and polymer and it's type with the mechanism

Curriculum CHEM456

1-General introduction to additives:

General introduction - definition of additives - historical overview of the use of additives

2- Classification of additives:

1.2 Additives used for protection purpose:

a. Antioxidants:

A-1: Antioxidants are null

A-2: Antioxidants for oils

A-3: Antioxidants for polymers

Types of antioxidants (primary and secondary) - Mechanism of action of antioxidants

C. Optical stabilizers:

D. -1 Photoactive stabilizers to protect the skin:

E. Optical stabilizers for the protection of polymers:

H. Types of optical stabilizers - the mechanics of how optical stabilizers work

F. Thermal stabilizers: Types of thermal stabilizers - The mechanics of how thermal stabilizers work.

G. Combustion preventers: Types of combustion preventers - Mechanism of operation of combustion preventers

2.2 Additives used for the purpose of improving specifications:

a. Plasticizers

B. Shock enhancers

C. Tensile strength improvers

D. Compatibilizers

Reference

1- Preservatives and additives in the food industries. Author: Prof. Dr. Abdullah Muhammad Jaafar

2- Antioxidants Classification and Applications in Lubricants

Majid Soleimani, Leila Dehabadi, Lee D. Wilson and Lope G. Tabil

3- Chemistry of macromolecules, updated by Prof. Dr. Corgis Abdul Adam

4- Additives in Polymer chapter 4

CHEM461 /

Curriculum CHEM461 Industrial Pollutant Chemistry:
Spreading awareness and reducing industrial pollution that destroys the environment in order to achieve sustainable growth.

1- A general introduction to pollution

A historical overview of international concerns with the problem of pollution - definition of pollution - pollution control law - basic components of nature and natural balance

2- Air pollution

2-1- Air pollutants and their main sources - dust and its natural and industrial sources

2-2- Units of measurement of pollutants - controlling sources of industrial dust pollution

2-3- Sulfur oxides (sources, reactions, methods of controlling sources of pollution)

2-4- Carbon monoxide gas (sources, reactions, methods of controlling sources of pollution)

2-5- Nitrogen oxides (sources, reactions, methods of controlling sources of pollution)

2-6- Hydrogen sulfide gas and methods of removing it

2-7-- Hydrocarbons and photo-oxidants (sources, reactions, methods of controlling sources of pollution)

2-8- Allergens in the air

2-9 - Smoking

2-10- Stranosphere pollution

3- Water pollution

3-1- Water pollution and its basic sources

3-2- Water pollution with crude oil

3-3- Water contamination with washing powders

3-4- Water pollution with pesticides

3-5- Water pollution with heavy metals (inorganic compounds)

3-6- Pollution with solid waste and methods of disposal

3-7- Water pollution with salinity

3-8- Thermal pollution

Reference:

1- Environmental pollution, translated by Korkis Abdul Adam

2- Industrial Pollution, written by Latif Hamid Ali

3- Industrial Chemistry and Industrial Pollution, written by Ahmed Abdel Karim