



ZIAUDDIN UNIVERSITY
EXAMINATION BOARD

Higher Secondary School Certificate (HSSC)

Examination syllabus

Chemistry XII

**Based on Provincial revised curriculum
(Sindh)**

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PREFACE

The Ziauddin University Examination Board (ZUEB) was established under **Sindh ACT XLI 2018**, with the primary objective of enhancing the quality of education in Sindh. ZUEB is responsible for administering examinations for the **Secondary School Certificate (SSC)** and **Higher Secondary School Certificate (HSSC)** in alignment with the most recent revisions to the **National Curriculum**, as outlined by the **Directorate of Curriculum Assessment and Research (DCAR), Sindh**. Through its ordinance, ZUEB is mandated to provide examination services for both English, Urdu, and Sindhi medium candidates from private schools across Sindh. This examination syllabus reflects ZUEB's dedication to achieving the educational goals set by the provincial authorities.

In collaboration with subject professors, ZUEB has developed a comprehensive syllabus for each subject. It is important to distinguish between the syllabus and the curriculum. The syllabus serves as a guide for both teachers and students, outlining the key areas of focus within the subject. It provides students with a clear understanding of what is expected of them in their studies and helps them prepare effectively for their exams.

This examination syllabus incorporates all cognitive outcomes derived from the **Provincial Curriculum Statement**, ensuring that assessments are both valid and reliable. While the focus is primarily on the cognitive domain, significant emphasis is placed on the application of knowledge and understanding.

The syllabus is made available to all stakeholders via the ZUEB website to assist affiliated schools in planning their teaching. It is crucial to note that the syllabus, rather than the prescribed textbook, forms the foundation of ZUEB examinations. Additionally, this syllabus supports the development of learning materials for both students and teachers. ZUEB remains committed to supporting students undertaking the SSC and HSSC courses by facilitating their learning outcomes through this detailed syllabus document.

To further assist in the learning process, ZUEB provides a dedicated **e-resource tab** on its website, offering both text-based and video content on various subjects. These 15-20 minute instructional videos, created around key subject concepts, allow students to learn at their own pace and convenience. The videos can be used as a reinforcement tool to revisit lessons already taught or as pre-lesson material. This initiative is an ongoing effort, and new videos will continue to be uploaded.

We encourage all students and educators to make the most of these resources for a more enriched and flexible learning experience.

Sincerely,

Shahbaz Nasim
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29.01.2025

Rationale For The Reviewed Provincial Curriculum

The process of revising the National Curriculum 2006 began in August 2004, when the newly elected government of Pakistan initiated education reforms across the country. These reforms included the introduction of a new National Education Policy, a National Education Census, and a revision of curricula (Ministry of Education, 2009).

In practice, the overhaul of the secondary school curriculum began in 2006, leading to a review of the scheme of studies for classes I to XII and the revision of curricula for 25 compulsory subjects.

The 18th Amendment to the Constitution of Pakistan, enacted in 2010, significantly altered the federal-provincial relationship by abolishing the "concurrent legislative list." This amendment granted provinces greater legislative and financial autonomy in sectors such as education and health. The most notable implication of the 18th Amendment for education was the transfer of responsibility for curriculum development, syllabus planning, policy formation, and educational standards to the provinces, marking a significant step forward for education.

In Sindh, the School Education Department tasked a Curriculum Review Team with revising the National Curriculum 2006 for all subjects. The goal was to create a curriculum better suited to the needs of students and teachers while aligning with the principles of the 18th Amendment. Subject-specific curriculum review committees were established to critically examine and align the curriculum's content, both contextually and textually, ensuring coherence across various subjects. The Bureau of Curriculum (BoC) played a crucial role in organizing workshops and meetings in Hyderabad to facilitate the completion of this task. The support of numerous educationists, researchers, and teachers was invaluable in successfully revising the curriculum.

The revised National Curriculum, along with the original version, is available on the DCAR website at http://dcar.gos.pk/BoC_Other_Pages/curriculum_dev.html for easy access.

The Ziauddin University Examination Board (ZUEB) SSC and HSSC syllabi are developed in accordance with the Sindh Revised Curriculum. To date, textbooks for various subjects have been developed based on the revised curriculum.

XII - LEARNING OUTCOMES

Chapter 13 Chemistry of Representative Elements

Introduction

Major Concepts

- 13.1 General group trends of representative elements
- 13.2 Reactions of Representative Elements.
- 13.3 Flame Test S – Block Elements
- 13.4. Chemistry of Important Compounds of S - Block Elements
- 13.5 Reactions of P – Block Elements
- 13.6 Chemical Behaviour of Halogens
- 13.7. Chemistry of Sulphuric Acid
- 13.8 Diagonal relationship of representative elements

Conceptual Linkages

This unit is built on

- Periodic Table (Grade IX-X)
- Periodicity of Properties (Grade IX-X)

LEARNING OUTCOMES

UNDERSTANDING:

Students will be able to:

- Recognize the demarcation of the Periodic Table into s block, p block, d block, and f block. (Understanding)
- Describe physical properties like atomic radius, ionization energy, electronegativity, electrical conductivity, oxidation states of elements and melting and boiling points of elements change within groups of representative elements (Analyzing)
- Explain reactions of S – Block elements with oxygen, water, Halogens, nitrogen, hydrogen, alcohol and acids. (Understanding)
- Enlist flame test of S – Block Elements (Applying)
- Explain Chemistry of Sodium Hydroxide and bleaching powder. (Understanding)
- Enlist functions of S – Block Elements and their important compounds in tabular form. (Understanding)
- Explain reactions of P – Block elements with oxygen, water, Halogens, nitrogen and hydrogen. (Understanding)
- Differentiate beryllium from other members of its group. (Analyzing)

UNDERSTANDING:

Students will be able to:

- Explain the relative behaviour of halogens as oxidizing agents and reducing agents. (Applying)
- Compare the acidity of hydrogen halides. (Analyzing)
- Distinguish between an oxide and a peroxide. (Understanding)
- Write representative equations for the formation of oxides and sulphides. (Applying)
- Explain Chemistry of Sulphuric acid (Understanding)
- Enlist functions of some P block elements and their important compounds in tabular form (Understanding)
- Compare the diagonal relationship of s and p block elements (Analyzing)

SKILLS:

Students will be able to:

- Perform flame tests and explain the appearance of colors in the flame. (Analyzing)
- Analyze acidic and basic Ions using various tests. (Analyzing)

SOCIETY, TECHNOLOGY AND SCIENCE:

Students will be able to:

- Describe how the food and beverage industry uses steel, tin, aluminum and glass for canning purposes. (Analyzing)
- Explain how certain elements are mined and extracted from the earth. (Applying)
- Relate the properties of the halogens to their important commercial uses. (Applying)
- Explain that iodine deficiency leads to goiter. (Understanding)
- Explain the applications of bleaching powder. (Understanding)
- Explain fluoride toxicity and deficiency. (Understanding)

Chapter 14

Chemistry of outer Transition (d-block) elements

Introduction

Major Concepts

- 14.1 General Features
- 14.2 Nomenclature of Coordination compounds
- 14.3 Chemistry of Some Important Transition Elements

Conceptual Linkages

This unit is built on

- Periodic Table (Grade IX-X)
- Periodicity of Properties (Grade IX-X)
- Metals and Metalloids (Grade IX-X)

LEARNING OUTCOMES

UNDERSTANDING:

Students will be able to:

- Describe electronic structures of elements and ions of d-block elements. (Applying)
- Explain why the electronic configuration for chromium and copper differ from those assigned using the Aufbau principle. (Analyzing)
- Describe general features of transition elements (Understanding)
- Enlist oxidation states of Cr, Mn, Fe, Co. (Applying)
- Explain origin of colors and nomenclature of coordination compounds. (Applying)
- Describe important reactions and uses of Chromium, Manganese, Iron and Copper.
- Define an alloy and describe some properties of an alloy that are different from the metals that compose it. (Analyzing)
- Describe the Steel, types and its applications. (Understanding)
- Enlist alloys of d block elements and their applications in tabular form (Applying).
- Describe the reactions of potassium dichromate with oxalic acid and Mohr's salt. (Understanding)
- Describe the reactions of potassium permanganate with ferrous sulphate, oxalic acid and Mohr's salt. (Understanding)
- Explain clearly the rules of nomenclature of coordination compounds with suitable examples (Applying)
- Enlist functions of some d block elements and their important compounds in tabular form.

SKILLS:

Students will be able to:

- Determine the concentration of iron (II) ions in solution by titration with KMnO_4 . (Applying)
- Understand the uses of Alloys in daily life. (Applying)

SOCIETY, TECHNOLOGY AND SCIENCE:

Students will be able to:

- Compare properties of Brass, Bronze and their constituent elements. (Applying)
- Identify that certain transition metal compounds are used in paints (Understanding)

Introduction**Major Concepts**

- 15.1 Sources
- 15.2 Coal as a source of Organic Compounds
- 15.3 Characteristics of Organic Compounds
- 15.4 Uses of Organic Compounds
- 15.5 New Allotrope of Carbon: Bucky Ball
- 15.6 Functional Groups and Homologous Series

Conceptual Linkages

This unit is built on

- Definition of Organic Chemistry (Grade IX-X)
- Sources and Uses of Organic Compounds (Grade IX-X)
- Functional Groups (Grade IX-X)
- Homologous Series (Grade IX-X)

LEARNING OUTCOMES**UNDERSTANDING:**

Students will be able to:

- Define organic chemistry and organic compounds. (Remembering)
- Explain why there is such a diversity and magnitude of organic compounds. (Analyzing)
- Explain the use of coal as a source of both aliphatic and aromatic hydrocarbons. (Understanding)
- Explain the use of plants as a source of organic compounds. (Understanding)
- Explain that organic compounds are also synthesized in the lab. (Understanding)
- Define functional groups and homologous series. (Remembering)
- Explain reforming of petroleum. (Understanding)
- Explain different uses of organic compounds in our daily life. (Understanding)
- Explain Bucky ball. (Understanding)

SKILLS:

Students will be able to:

- Make distinction among different organic compounds on the basis of their formula.
(Analyzing)

SOCIETY, TECHNOLOGY AND SCIENCE:

Students will be able to:

- Realize that many organic compounds are obtained from plants and animals.
(Understanding)
- Understand that organic compounds are partially or totally synthesized in the lab.
(Understanding)
- List many medicines are obtained from plants. (Remember)

Introduction**Major Concepts**

- 16.1 Introduction of Hydrocarbons and their derivatives
- 16.2 History of Nomenclature
- 16.3 IUPAC System
- 16.4 Nomenclature of Alkane.
- 16.5 Nomenclature of Alkene
- 16.6 Nomenclature of Alkyne
- 16.7 Nomenclature of Alkyl Halide
- 16.8 Nomenclature of Amines
- 16.9 Nomenclature of Alcohol
- 16.10 Nomenclature of Phenol
- 16.11 Nomenclature of Ether
- 16.12 Nomenclature of Aldehyde and Ketone
- 16.13 Nomenclature of Carboxylic Acid
- 16.14 Nomenclature of Ester
- 16.15 Nomenclature of Amide
- 16.16 Nomenclature of Acyl Halides

LEARNING OUTCOMES**UNDERSTANDING:**

Students will be able to:

- Enlist the families of organic compound with functional groups. (Remembering)
- Describe nomenclature rules of each family by applying common name system and IUPAC system. (Understanding)
- Write nomenclature of alkane, alkene, alkyne cyclo alkanes with five examples of each family. (Applying)
- Write nomenclature of Alkyl Halide, Amine, Ether, alcohol, Phenol, Aldehyde, Ketone, Carboxylic acid, Ester, Amide and Acyl Halide with at least five examples of each family. (Applying)
- Explain the outlines to draw structures for IUPAC of organic compounds of each family. (Applying)
- Explain outlines to draw structures of common names of organic compounds of each family. (Applying)

SKILLS:

Students will be able to:

- Know about the structural formulas of organic compounds. (Understanding)
- Draw structures of compounds and to name them in accordance with IUPAC system. (Applying)

SOCIETY, TECHNOLOGY AND SCIENCE:

Students will be able to:

- Name the organic compounds. (Applying)
- Draw the structure of organic compound. (Applying)

Introduction**Major Concepts**

- 17.1 Types of Hydrocarbons
- 17.2 Alkanes and Cycloalkanes
- 17.3 Radical Substitution Reactions
- 17.4 Alkenes
- 17.5 Isomerism
- 17.6 Alkynes
- 17.7 Benzenes and Substituted Benzenes

Conceptual Linkages

This unit is built on

- Introduction to Alkane and Alkyl Radicals (Grade IX-X)
- Alkenes and Alkynes (Grade IX-X)

LEARNING OUTCOMES**UNDERSTANDING:**

Students will be able to:

- Classify hydrocarbons as aliphatic and aromatic. (Understanding)
- Explain the shapes of alkanes and cycloalkanes exemplified by ethane and cyclopropane. (Applying)
- Explain unreactive nature of alkanes towards polar reagents. (Applying)
- Define homolytic and heterolytic fission, free radical initiation, propagation and termination. (Remembering)
- Describe the mechanism of free radical substitution in alkanes exemplified by methane and ethane. (Understanding)
- Explain what is meant by a chiral centre and show that such a centre gives rise to optical isomerism. (Understanding)
- Identify chiral centers in given structural formula of a molecule. (Analyzing)
- Analyze glucose molecules by optical activity. (Applying)
- Explain the terms isomerism and structural isomerism with suitable examples. (Remembering)
- Define stereoisomerism (cis and trans) with example of alkene. (Remembering)
- Explain shape of ethene molecule in terms of sigma and pi C-C bonds. (Understanding)
- Describe the structure and reactivity of alkenes as exemplified by ethene. (Applying)
- Draw all possible isomers of molecular formula C_4H_{10} , C_5H_{12} , C_4H_8 , C_5H_{10} , C_4H_6 , C_5H_8 with their IUPAC names. (Applying)

- Draw all possible isomers of molecular formula C_3H_7OH , C_3H_7Cl , $C_4H_9NH_2$ with their IUPAC names. (Applying)
- Draw all possible isomers of molecular formula C_2H_6O , C_3H_6O , $C_2H_4O_2$ with their IUPAC names. (Applying)
- Explain dehydration of alcohols and dehydrohalogenation of RX for the preparation of ethene. (Understanding)
- Describe the chemistry of alkenes by the following reactions of ethene: Hydrogenation, hydrohalogenation, hydration, halogenation, halohydrate, epoxidation, ozonolysis, polymerization. (Understanding)
- Explain the shape of benzene molecule (molecular orbital aspect). (Understanding)
- Describe what is meant by the term delocalized electrons in the context of the benzene ring. (Understanding)
- Describe addition reactions of Benzene (with hydrogen and halogen). (Understanding)
- Describe the general mechanism of electrophilic substitution in benzene. (Understanding)
- Discuss the electrophilic reactions of benzene and toluene (nitration, sulphonation, halogenation, Friedel Craft's alkylation and acylation). (Applying)
- Apply the knowledge of positions of substituents in the electrophilic substitution of benzene. (Applying)
- Compare the reactivity of alkanes, alkenes and alkynes. (Analyzing)
- Discuss the shape of acetylene in terms of sigma and pi bonds. (Applying)
- Describe the preparation of alkynes using elimination reactions. (Applying)
- Describe acidity of acetylene. (Understanding)
- Discuss reaction of alkynes by hydrogenation, hydrohalogenation, hydration, bromination, ozonolysis, and reaction with metals. (Understanding)

SKILLS:

Students will be able to:

- Draw different possible ring structures of benzene (Kekule structures). (Understanding)
- Draw the structures of alkanes, alkenes and alkynes up to 10 carbon atoms. (Understanding)

SOCIETY, TECHNOLOGY AND SCIENCE:

Students will be able to:

- Identify and link uses of various hydrocarbons used in daily life. (understanding)
- Identify various hydrocarbons which will be important as fuels for the future energy needs of Pakistan (understanding)

Chapter 18

Alkyl Halides and Amines

Introduction

Major Concepts

- 18.1 Alkyl Halides
- 18.2 Grignard's Reagents (Organometallic Compounds)
- 18.3 Amines

Conceptual Linkages

This unit is built on

- Functional Groups (Grade IX-X)
- Amino Acids (Grade IX-X)

LEARNING OUTCOMES

UNDERSTANDING:

Students will be able to:

- Discuss the physical properties, structure and reactivity of RX. (Understanding)
- Describe the preparation of RX by the reaction of alcohols with HX, SOCl₂ and PX₃ and by halogenation of alkanes. (Understanding)
- Explain the mechanism and types of nucleophilic substitution reactions. (Applying)
- Explain the mechanism and types of elimination reactions. (Applying)
- Compare the nucleophilic substitution versus elimination reaction. (Analyzing)
- Explain the preparation and reactivity of Grignard's Reagents. (Applying)
- Applications of Grignard's reagent (Water, esters and carbon dioxide and amines). (Applying)
- Explain the structure and basicity of amines. (Applying)
- Describe the preparation of amines by alkylation of ammonia to RX and reduction of nitriles, nitro and amide functional groups. (Understanding)
- Explain the reactions of amines (RX, aldehydes, ketones) and preparation of amides and diazonium salts. (Understanding)
- Enlist the important compounds of Alkyl Halides and Amines with their applications. (Applying)
- Explain the reactivity of alkyl halide with respect to polarity of C- X bond. (Understanding)
- Explain why primary alkyl halide favors SN² reactions and tertiary alkyl halide SN¹. (Understanding)

SKILLS:

Students will be able to:

- Identify amines in the laboratory by carrying out appropriate tests. (Applying)
- Perform tests to detect nitrogen in organic compounds. (Applying)

SOCIETY, TECHNOLOGY AND SCIENCE:

Students will be able to:

- Identify organometallic compounds in medicines. (understanding)
- Compare hemoglobin and chlorophyll. (Understanding)
- Recognize alkyl halides as precursors of many organic compounds. (Applying)

Chapter 19 Alcohols, Phenols and Ethers

Introduction

Major Concepts

- 19.1 Alcohols
- 19.2 Phenols
- 19.3 Ethers

Conceptual Linkages

This unit is built on

- Functional Groups (Grade IX-X)

LEARNING OUTCOMES

UNDERSTANDING:

Students will be able to:

- Describe the physical properties and structure of alcohol. (Understanding)
- Explain the preparation of alcohols by reduction of aldehydes, ketones, carboxylic acids and esters. (Applying)
- Explain the preparation of alcohols by hydrolysis of alkyl halide and Grignard reagent with aldehyde and ketone. (Applying)
- Describe reactivity of alcohols (Understanding)
- Describe the preparation of ether and ester by alcohol and oxidative cleavage of 1, 2-diols. (Understanding)
- Discuss the physical properties and structure of phenols. (Applying)
- Explain the preparation of phenol from chlorobenzene and hydrolysis of diazonium salts. (Applying)
- Explain the reactions of phenol. (Applying)
- Differentiate between alcohol and phenol. (Understanding)
- Enlist the important compounds of Alcohols, Phenols and Ethers with their application (Applying)
- Explain identification test of alcohol and phenol. (Understanding)

SKILLS:

Students will be able to:

- Discuss the physical properties, structure of ether.
- Describe the preparation and chemical reactivity of ether.

SOCIETY, TECHNOLOGY AND SCIENCE:

Students will be able to:

- Explain the role of disinfectants in hygiene. (Analyzing)
- Differentiate between disinfectants and antiseptics. (Understanding)
- Recognize that ethers are used in anesthesia (Applying)

Introduction**Major Concepts**

- 20.1 Physical Properties
- 20.2 Structure
- 20.3 Preparations of Aldehydes and Ketones
- 20.4 Reactivity
- 20.5 Reactions of Aldehydes and Ketones

Conceptual Linkages

This unit is built on

- Functional Groups (Grade IX-X)

LEARNING OUTCOMES**UNDERSTANDING:**

Students will be able to:

- Explain the physical properties and structure of aldehydes and ketones. (Understanding)
- Explain the preparation of aldehydes and ketones by ozonolysis of alkenes, hydration of alkynes, oxidation of alcohols and Friedel Craft's acylation of aromatics. (Applying)
- Describe reactivity of aldehydes and ketones. (Understanding)
- Explain acid and base catalysed nucleophilic addition reactions of aldehydes and ketones. (Applying)
- Explain reactions of aldehydes and ketones. (Applying)
- Describe oxidation reactions of aldehydes and ketones. (Applying)
- Compare the aldehyde and ketone with reference to their laboratory test (tabular form)(Understanding)
- Enlist the important compounds of Aldehydes and Ketones with their application. (Applying)

SKILLS:

Students will be able to:

- Identify aldehydes in the laboratory tests. (Applying)
- Identify ketones using appropriate laboratory tests. (Applying)
- Determine melting or boiling points of aldehydes and ketones in laboratory. (Applying)

SOCIETY, TECHNOLOGY AND SCIENCE:

Students will be able to:

- Explain how oxidation and reduction alters the structure of organic compounds. (Understanding)
- Explain the need to limit exposure to formaldehyde vapors as used in adhesives, varnishes, paints, foam insulation and permanent press clothing. (Applying)
- Describe glucose and fructose as examples of aldehydes and ketones (Understanding)
- Explain the role of ozonolysis in sterilization of drinking water. (Applying)

Chapter 21 Carbonyl Compounds 2: Carboxylic Acids and Functional derivatives

Introduction

Major Concepts

- 21.1 Physical Properties
- 21.2 Structure
- 21.3 Acidity
- 21.4 Preparations of Carboxylic Acids and their derivatives
- 21.5 Reactions of Carboxylic Acids and their derivatives

Conceptual Linkages

This unit is built on

- Functional Groups (Grade IX-X)

LEARNING OUTCOMES

UNDERSTANDING:

Students will be able to:

- Discuss the physical properties and acidity of carboxylic acid. (Understanding)
- Describe preparation of carboxylic acids by carbonation of Grignard's Reagent, hydrolysis of nitriles, oxidation of primary alcohols, oxidation of aldehydes and oxidation of alkyl benzenes. (Applying)
- Conversion of carboxylic acids into their derivatives (acyl halides, acid anhydrides, esters, amides) without mechanism. (Applying)
- Enlist the important compounds of carboxylic acids and their derivatives with their application. (Applying)

SKILLS:

Students will be able to:

- Identify carboxylic acids in the laboratory (Applying)
- Determine melting or boiling points of carboxylic acids in laboratory. (Applying)

SOCIETY, TECHNOLOGY AND SCIENCE:

Students will be able to:

- Enlist carboxylic acids present in fruits, vegetables and other natural products. (Applying)
- Link different carboxylic acids with their characteristic test. (Applying)
- Recognize carboxylic acids used as preservatives in food and food products. (Applying)

Introduction**Major Concepts**

- 22.1 Carbohydrates
- 22.2 Proteins
- 22.3 Lipids
- 22.4 Minerals of Biological Significance

Conceptual Linkages

This unit is built

- Carbohydrates (Grade IX-X)
- Proteins (Grade IX-X)
- Lipids (Grade IX-X)
- Nucleic Acids (Grade IX-X)

LEARNING OUTCOMES**UNDERSTANDING**

Students will be able to

- Discuss the natural sources of Carbohydrates and classification based on structure. (understanding)
- Enlist the role of various Carbohydrates in health and diseases. (Applying)
- Identify the nutritional importance and their role as energy storage (Applying)
- Explain the classification of protein on the basis of structure and their functions. (Applying)
- Explain classification and Functions of Lipids. (Applying)
- Enlist sources and the role of Iron, Calcium, Phosphorous and Zinc in nutrition. (Applying)

SKILLS:

Students will be able to:

- know Calcium as a requirement for coagulation (Applying)
- know how milk proteins can be precipitated by lowering the pH using lemon juice (Applying)

SOCIETY, TECHNOLOGY AND SCIENCE:

Students will be able to:

- Explain why animals and humans have large glycogen deposits for sustainable muscular activities. Hibernating animals (polar bear, reptiles and amphibians) accumulate fat to meet energy resources during hibernation. (Understanding)
- Know complex Carbohydrates which provide lubrication to elbow and Knee. (Understanding)
- Describe fibrous proteins from hair and silk. (Applying)
- Explain how Cholesterol and amino acid serve as hormones. (Understanding)
- Know insulin as a protein hormone whose deficiency leads to diabetes mellitus. (Understanding)
- Explain the role of minerals in human body. (Understanding)

Introduction**Major Concepts**

- 23.1 Introduction to Chemical Industry
- 23.2 Pharmaceutical Industry
- 23.3 Pesticides
- 23.4 Synthetic Polymers (PVC and Nylon)
- 23.5 Cosmetics: Lipstick, Nail Polish and Remover, Perfumes.
- 23.6 Adhesive

Conceptual Linkages

This unit is built on

- Basic Metallurgical Operations (Grade IX-X)

LEARNING OUTCOMES**UNDERSTANDING:**

Students will be able to:

- Explain the role of the chemical industries in the economy of Pakistan. (Analyzing)
- Describe the various pharmaceutical products (Understanding)
- Enlist different pharmaceutical products with their functions (Applying)
- Explain the formation and uses of PVC and Nylon. (Applying)
- Describe the composition and effects of various cosmetics like nail polish, nail polish remover, lipsticks and perfumes (Understanding)
- Describe the adhesives and their applications. (Understanding)

SKILLS:

Students will be able to:

- Know different types of Industries in Pakistan and their importance.

SOCIETY, TECHNOLOGY AND SCIENCE:

Students will be able to:

- Trace the development and uses of different synthetic fibers. (Applying)
- Know about pharmaceutical products, cosmetics etc. (Understanding)

Introduction**Major Concepts**

- 24.1 Chemistry of the Troposphere
- 24.2 Chemistry of the Stratosphere
- 24.3 Water Pollution and Water Analysis
- 24.4 Green Chemistry

Conceptual Linkages

This unit is built on

- Composition of Atmosphere (Grade IX-X)
- Layers of Atmosphere (Grade IX-X)
- Air Pollutants (Grade IX-X)
- Ozone (Grade IX-X)

LEARNING OUTCOMES**UNDERSTANDING:**

Students will be able to:

- Recognize various chemical reactions occurring in the atmosphere. (Understanding)
- Recognize that the release of CO_x, SO_x, NO_x, VOCs are associated with the combustion of hydrocarbon based fuels. (Applying)
- Outline problems associated with release of pollutants including acid rain. (Understanding)
- Describe causes and impacts of smog. (Analyzing)
- Explain greenhouse effect and global warming as resulting in climate change. (Analyzing)
- Explain the buildup and the adverse effects of ozone in the troposphere. (Applying)
- Describe the role of CFCs in destroying ozone in the stratosphere. (Applying)
- Describe the role of ozone in the stratosphere in reducing the intensity of harmful UV radiation reaching the earth. (Understanding)
- List possible alternatives of CFCs. (Applying)
- Recognize and describe various water pollutants. (Applying)
- Explain the various parameters of drinking water analysis and compare with WHO standard limits. (Applying)
- List some major products of petrochemicals industry with their uses. (Applying)

SKILLS:

Students will be able to:

- Estimate chloride ions in tap water using titration technique. (Applying)
- Understand the main parameters for drinking water. (Applying)

SOCIETY, TECHNOLOGY AND SCIENCE:

Students will be able to:

- Describe how properties of gases promote greenhouse effect. (Analyzing)
- Make connections between Halogens and CFCs and their effects on ozone depletion. (Analyzing)
- Predict effects of radiation pollution. (Applying)
- Explain the need to work in a well-ventilated area when working with toxic solvents as used in adhesives. (Applying)
- Describe how rain water seepage through hazardous wastes dumpsites can dissolve and reach drinking water supplies. (Applying)
- Describe three ways in which water is purified. (Applying)
- Identify ways in which air pollution resulting from auto exhausts can be alleviated. (Applying)
- Recognize the use of catalytic converters in reducing pollutant emissions from petrol driven vehicles. (Analyzing)
- Differentiate between ozone at the earth's surface and ozone formation and depletion in the atmosphere. (Applying)
- Realize that dumping wastewater from household and industry without treatment to the rivers and creeks is dangerous for the environment. (Understanding)

Chapter 25 Spectroscopy

Introduction

Major Concepts

25.1 Methods of Spectroscopy

Conceptual Linkages

This unit is built on

- Structure of atoms and molecules (Grade IX-X)

LEARNING OUTCOMES

UNDERSTANDING:

Students will be able to:

- Define spectroscopy and discuss its applications in different fields (Understanding)
- Enlist the regions of electromagnetic spectrum used in IR and UV/vis spectroscopy (Applying)
- Identify Ethanol by using different techniques of Spectroscopy. (Applying)
- Explain atomic emission and atomic absorption spectrum. (Understanding)
- Describe the application of NMR, UV, IR and Mass Spectroscopy in different fields. (Understanding)

SKILLS:

Students will be able to:

- Understand and Interpret the compound by using spectroscopic techniques

SOCIETY, TECHNOLOGY AND SCIENCE:

Students will be able to:

- Explain how different instruments help in the study of chemistry. (Analyzing)
- Explain how forensic chemists use the MS to identify small amounts of unknown material. (Applying)
- Explain why forensic chemists must have strong problem-solving skills and a broad background in analytical chemistry. (Applying)
- Recognize the link between chemical instrumentation and technology (Analyzing)
- Explain how to analyze food, agriculture and pharmaceutical products by using different spectroscopic techniques (Applying)

DEFINITIONS OF COGNITIVE LEVELS

Remember

Remembering is the act of retrieving knowledge and can be used to produce things like definitions or lists. The student must be able to recall or recognise information and concepts. The teacher must present information about a subject to the student, ask questions that require the student to recall that information and provide written or verbal assessment that can be answered by remembering the information learnt.

Question Stems

- Can you name all the ...?
- Describe what happens when ...?
- How is (are) ...?
- How would you define ...?
- How would you identify ...?
- How would you outline ...?
- How would you recognise...?
- List the ... in order.
- What do you remember about ...?
- What does it mean?
- What happened after?
- What is (are) ...?
- What is the best one?
- What would you choose ...?
- When did ...?
- Where is (are) ...?
- Which one ...?
- Who spoke to ...?
- Who was ...?
- Why did ...?

Understand

The next level in the taxonomic structure is Understanding, which is defined as the construction of meaning and relationships. Here the student must understand the main idea of material heard, viewed, or read and interpret or summarise the ideas in their own words. The teacher must ask questions that the student can answer in their own words by identifying the main idea.

Question Stems

- Can you clarify...?
- Can you illustrate ...?
- Condense this paragraph.
- Contrast ...
- Does everyone think in the way that ... does?
- Elaborate on ...
- Explain why ...
- Give an example
- How can you describe...?
- How would you clarify the meaning...?
- How would you compare ...?
- How would you differentiate between ...?
- How would you describe...?
- How would you generalise...?
- How would you identify ...?
- Is it valid that ...?
- Is this the same as ...?
- Outline ...
- Select the best definition...
- State in your own words...
- This represents ...
- What are they saying?
- What can you infer from ...?
- What can you say about ...?
- What could have happened next?
- What did you observe?

	<ul style="list-style-type: none"> • What does this mean? • What expectations are there? • What information can you infer from...? • What is the main idea of ...? • What restrictions would you add? • What seems likely? • What seems to be ...? • What would happen if ...? • What might happen if ...? • Which are the facts? • Which statements support ...?
<p>Apply</p> <p>The third level in Bloom's taxonomy, Applying, marks a fundamental shift from the pre-Bloom's learning era because it involves remembering what has been learnt, having a good understanding of the knowledge, and applying it to real-world exercises, challenges or situations. Students must apply an abstract idea in a concrete case to solve a problem or relate it to prior experience. The teacher must provide opportunities for students to use theories and problem-solving techniques in new situations and review and check their work. Assessment questions should be provided that allow students to define and solve problems.</p> <p>Question Stems</p> <ul style="list-style-type: none"> • Can you group by characteristics such as ...? • Choose the best statements that apply... • Clarify why ... • Do you know of another instance where ...? • Draw a story map... • Explain why a character acted in the way that he did... • From the information given, can you develop a set of instructions about ...? • How would you develop ...? • How would you change ...? • How would you demonstrate...? 	<p>Analyse</p> <p>Analysing is the cognitive level where students can take the knowledge they have remembered, understood and applied, then delve into that knowledge to make associations, discernments or comparisons. Students should break down a concept or idea into parts and show relationships between these parts. Teachers must give students time to examine concepts and their requisite elements. Students are required to explain why they chose a solution.</p> <p>Question Stems</p> <ul style="list-style-type: none"> • Can you distinguish between ...? • Can you explain what must have happened when ...? • Determine the point of view, bias, values, or intent underlying the presented material... • Discuss the pros and cons of ... • How can you classify ... according to ...? • How can you compare the different parts? • How can you sort the different parts...? • How is ... connected to ...? • How is ... similar to ...? • How would you categorise...? • How would you explain...?

<ul style="list-style-type: none"> • How would you develop? • How would you explain ...? • How would you modify ...? • How would you present...? • How would you solve ... ? • Identify the results of ... • Illustrate the ... • Judge the effects of ... What would result ...? • Predict what would happen if ... • Tell how much change there would be if ... • Tell what would happen if ... • What actions would you take to perform ...? • What do you think could have happened next? • What examples can you find that ? • What other way would you choose to ...? • What questions would you ask of ...? • What was the main idea ...? • What would the result be if ...? • Which factors would you change if ...? • Who do you think...? • Why does this work? • Write a brief outline ... • Write in your own words ... 	<ul style="list-style-type: none"> • What could the ending have been if ... had taken place? • State the point of view of ... • What are some of the problems of ...? • What assumptions ...? • What can you infer about...? • What can you point out about ? • What conclusions ...? • What do you see as other possible outcomes? • What does the author assume? • What explanation do you have for ...? • What ideas justify the conclusion? • What ideas validate...? • What is the analysis of ...? • What is the function of ...? • What is the problem with ...? • What motive is there? • What persuasive technique is used? • What statement is relevant? • What was the turning point? • What were some of the motives behind ...? • What's fact? Opinion? • What's the main idea? • What's the relationship between? • Which events could not have happened? • Why did ... changes occur? • Why do you think ?
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BLOOM'S TAXONOMY WITH EXAMPLES

Conclusion

If you are a teacher looking for ways to engage your students in learning, this LIST of questions might be interesting for your classroom practice. Bloom's Taxonomy question stems can help elicit higher-order thinking skills and promote critical thinking among learners at different taxonomy levels. These question stems can also encourage students to think about their knowledge through reflection before answering questions.

ACTION WORDS FOR COGNITIVE LEVELS

Knowledge	Understand	Apply	Analyze	Evaluate	Create
					
define	explain	solve	analyze	reframe	design
identify	describe	apply	appraise	criticize	compose
describe	interpret	illustrate	judge	evaluate	create
label	paraphrase	modify	support	order	plan
list	summarize	use	compare	compare	combine
name	classify	calculate	decide	classify	formulate
state	compare	change	discriminate	contrast	invent
match	differentiate	choose	recommend	distinguish	hypothesize
recognize	discuss	demonstrate	summarize	infer	substitute
select	distinguish	discover	assess	separate	write
examine	extend	experiment	choose	explain	compile
locate	predict	relate	convince	select	construct
memorize	associate	show	defend	categorize	develop
quote	contrast	sketch	estimate	connect	generalize
recall	convert	complete	grade	differentiate	integrate
reproduce	demonstrate	construct	measure	divide	modify
tabulate	estimate	dramatize	predict	order	organize
tell	express	interpret	rank	prioritize	prepare
Copy	identify	manipulate	score	survey	produce

discover	indicate	paint	select	calculate	rearrange
duplicate	infer	prepare	test	conclude	rewrite
enumerate	relate	teach	argue	correlate	adapt
listen	restate	act	conclude	deduce	anticipate
observe	select	collect	consider	devise	arrange
omit	translate	compute	critique	diagram	assemble
read	ask	explain	debate	dissect	choose
recite	cite	list	distinguish	estimate	collaborate
record	discover	operate	editorialize	evaluate	facilitate
repeat	generalize	practice	justify	experiment	imagine
retell	group	simulate	persuade	focus	intervene
visualize	illustrate	transfer	rate	illustrate	make
	judge	write	weigh	organize	manage
	observe			outline	originate
	order			plan	propose
	report			question	simulate
	represent			test	solve
	research				support
	review				test
	rewrite				validate
	show				

HSSC PART II EXAMINATION

MARKS BREAKUP GRID FOR EXAMINATION 2025

GROUP: PRE-MEDICAL

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / SINDHI NORMAL	100	-	100
PAKISTAN STUDIES	50	-	50
PHYSICS	85	15	100
CHEMISTRY	85	15	100
BIOLOGY	85	15	100
TOTAL	505	45	550

GROUP: PRE-ENGINEERING

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / SINDHI NORMAL	100	-	100
PAKISTAN STUDIES	50	-	50
PHYSICS	85	15	100
CHEMISTRY	85	15	100
MATHEMATICS	100	--	100
TOTAL	520	30	550

GROUP: GENERAL SCIENCE

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / SINDHI NORMAL	100	-	100
PAKISTAN STUDIES	50	-	50
PHYSICS	85	15	100
COMPUTER SCIENCE	75	25	100
MATHEMATICS	100	--	100
TOTAL	510	40	550

GROUP: COMMERCE

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / SINDHI NORMAL	100	-	100
PAKISTAN STUDIES	50	-	50
ECONOMICS	75	-	75
P.O.C	75	-	75
ACCOUNTING	100	--	100
BUSINESS MATHEMATICS	50		50
TOTAL	550	---	550

GROUP: HUMANITIES

(Any Three Electives)

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / SINDHI NORMAL	100	-	100
PAKISTAN STUDIES	50	-	50
COMPUTER SCIENCE	75	25	100
ISLAMIC STUDIES	100		100
MATHEMATICS	100	-	100
SOCIOLOGY	100	--	100
ECONOMICS	100		100
EDUCATION	100		100
CIVICS	100		100
NURSING	85	15	100
TOTAL	550	---	550

GROUP: MEDICAL TECHNOLOGY

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / SINDHI NORMAL	100	-	100
PAKISTAN STUDIES	50	-	50
MICROBIOLOGY	85	15	100
CHEMICAL PATHOLOGY & SEROLOGY	85	15	100
ELEMENTARY CHEMISTRY & CHEMICAL PATHOLOGY	85	15	100
TOTAL	505	45	550