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NATIONAL CURRICULUM

CHEMISTRY

CLASSES XI-XII

2000

GOVERNMENT OF PAKISTAN
MINISTRY OF EDUCATION
(CURRICULUM WING)
ISLAMABAD

National Curriculum

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PREFACE

In pursuance of National Education Policy (1998-2010), a project on Curriculum Reforms (Vision 2010) is in progress. It aims to improve the quality of education through curriculum revision and textbook development. The highest priority has been assigned to the revision of curriculum with a view to update the entire course contents so that Ideology of Pakistan could permeate the thinking of young generation and help them with necessary conviction and ability.

Believing in participatory approach the Ministry of Education requested the provincial governments/Curriculum Bureau to draft need based curricula in all the subjects for classes I through XII. Consequent upon this the Government of the Punjab attempted five initial drafts in Science and Mathematics. The Bureaus of Sindh, N.W.F.P. and Baluchistan furnished their comments on the previous as well as proposed curricula. To synchronize the feedback, the Ministry of Education appointed National Curriculum Development Committees. The panels of the committees were comprised of curriculum developers, subject specialists, educationists, teachers of universities, schools and colleges. The representatives of National Curriculum Bureau and Provincial Curriculum Bureaus were also represented on the panels. The committees thoroughly analyzed and synthesized the comments. Global experiences of curriculum development were also kept in view while revising/ updating the National Curriculum.

In the light of the above considerations, the committees revised the existing National Curriculum in Elementary Science (I-VIII), Physics, Chemistry, Biology (IX-XII), Statistics (XI, XII), Computer Science (IX-XII) and Mathematics (I-XII). The philosophy underlying National Curriculum is Islam and Ideology of Pakistan as set by the Parliament Act X, 1976. The objectives of the National Curriculum are framed in the light of the objectives of the latest National Education Policy (1998-2010). Purposeful learning competencies are suggested in each subject. These aim to provide the learners, skills for continuing education, civilized behaviour and attitude to become useful and peaceful citizens. The objective is also to provide them with the skills for economic development. The curriculum has been made more representative and responsive to the Ideology of Pakistan and social needs. We still believe that curriculum development is a continuous process and can be made more responsive. The Ministry would welcome comments from all concerned. This will help us in making the curriculum more effective and need based.

The Ministry of Education appreciates the contributions of all the Provincial Governments/ Curriculum Bureaux and the National Curriculum Development Committees.

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Aims

The broad aims of this syllabus are that the students should be able to:

1. Develop an interest in chemistry
2. Seek knowledge and enjoyment from the subject of chemistry.
3. develop an ability to think scientifically
4. acquyire an ability to perform experiment.
5. acquire an ability to solve problems.
6. observe accurately and objectively.
7. Develop an awareness of the social, economical and technological implication of chemistry.

General Objectives.

The chemistry curriculum for secondary classes was developed keeping in mind the following general objectives:

1 To enable learners to develop understanding, science process skill and scientific attitude to appreciate chemistry as a changing and growing human activity.

2 To be able to apply the knowledge and principles learned in explaining phenomena or solving problems related to chemistry.

3 To enable learners to formulate opinions in solving community problems especially related to environment.

4 To provide opportunities to understand social and economic issues related to chemistry.

5 To prepare the students to adopt careers in chemistry based field of science and technology.

6 To prepare the students for studies beyond higher secondary level.

7 To develop imaginative and critical thinking.

8 To develop self nutrition and the ability to work in a sustained fashion.

9 To be able to recognize the usefulness and limitations of scientific method and to appreciate the interrelationship between different disciplines.

Specific Objectives

The syllabus content is based on the following specific objectives:

A. Knowledge, understanding and applications

Students should be able to:

1 Understand certain useful facts, laws, principles, theories and concepts in chemistry.

2 Communicate using an adequate chemistry vocabulary.

3 Apply the knowledge and principles learned in explaining physical phenomena or solving problems related to chemistry.

4 Understand the relevant applications of chemistry in society and in every day life.

5 Use generalization and models to make predictions.

B. Practical Skills

Students should be able to:

1 Follow sequence of instructions, learn techniques and safe handling of apparatus and chemicals.

2 Observe and record experimental observations accurately.

3 Interpret and evaluate observations and experimental data.

4 Manipulate numerical and other data.

5 Select appropriate apparatus to design experiments.

6 Analyze and evaluate chemical information of a qualitative and quantitative nature and draw valid conclusions.

C. Attitudes

Students should be able to:

1 Develop curiosity and interest in making scientific investigations.

2 Accept that theories and models have both usefulness and limitations in making predications and describing physical phenomena.

3 Develop personal integrity through objective observations and honest recording of experimental data.

4 Cooperate with others in scientific inquiry.

5 Show awareness of the moral, economics, political and social consequences of the applications of chemistry to meet human needs.

6 Develop attitudes relevant to science such as inquiry and inventiveness.

Contents and scope chemistry syllabus classes XI & XII

Chemistry Part-I

Contents	Scope
Chapter-1	
The Basic Concepts.	
1.1 Atom, Molecule, Ion and Molecular Ion.	Concept and brief description.
1.2 Relative atomic mass and relative molecular mass.	Recall.
1.3 Determination of relative atomic masses of isotopes by Mass Spectrometry.	Working of Mass Spectrometer is not required.
1.4 Determination of empirical and molecular formula.	Illustrate with examples.
1.5 The mole, Avogadro's number and molar volume.	Recall.
1.6 Stoichiometric calculations.	Concept of Stoichiometry. Calculation based on balance chemical equation.
1.7 Limiting Reactant.	Concept and brief description.
1.8 Percentage yield.	Concept and calculation.
Chapter-2	
Experimental Techniques in Chemistry.	
2.1 Filtration	Principle and brief description with diagram.
2.2 Crystallization	Brief description.
2.3 Sublimation.	Brief description.

2.4 Solvent extraction.	Brief description.
2.5 Chromatography	Principe and brief description of paper chromatography.

Chapter-3

The Gases.

3.1 States of matter.	Recall general properties of solids, liquids and gases.
3.2 Ideal gas laws.	Boyle's law and its verification, Charles law & derivation of absolute zero, avogadro's law. Diffusion and effusion Graham's Law of diffusion & its verification and Dalton's Law of partial pressure. Statement of the laws, related calculations and solved examples.
3.3 Kinetic theory of gases.	Main postulates and derivation of gas laws from it.
3.4 Kinetic interpretation of temperature.	Description of all types of molecular motions &their dependence on temperature.
3.5 Ideal gas equation.	Derivation of gas equation & calculations based on it.
3.6 Liquefaction of gases.	Concept of critical temperature.
3.7 Real gases & their deviation from ideal behaviour.	Real gases depart from ideal behaviour at high pressure and at low temperature. Vander Waals explanation of this behaviour.
3.8 Plasma state.	A brief introduction of plasma state and its properties.

Chapter-4

Liquids and Solids.

4.1 Intermolecular forces.	Hydrogen bonding with reference to H_2O, HF & NH_3. Dipole-Dipole interactions, London dispersion forces. Effect of these forces on physical properties of compounds.
4.2 Phase changes	Description and measurement of vapor pressure, boiling point-effect of pressure on boiling point, Energetic of phase changes.
4.3 Liquid crystals.	Brief explanation.
4.4 Solids.	Crystalline & amorphous solids. Difference with examples. Properties of crystalline solids.
4.5 Unit cell & crystal lattice	Concepts of unit cell and crystal lattice, Lattice energy of NaCl.

4.6 Crystals & their classification.	Seven crystal systems on the basis of dimensions of the unit cell.
4.7 Different types of solids.	Characteristics of ionic, covalent, metallic and molecular solids. Structure of NaCl, solid iodine, diamond and metals.
4.8 Determination of Avogadro's number.	Simple method for determination of Avogadro's number.

Chapter-5

Atomic Structure.

5.1 Subatomic particles of atom.	Discovery of electron, proton and neutron. Characteristics of these particles. Mass and charge of these particles.
5.2 Rutherford model of atom.	Descriptive treatment.
5.3 Bohr's model of atom	Derivation of radius and energy of electron in nth orbit.
5.4 Spectrum of hydrogen atom.	Concept of spectrum. Difference between continuous and line spectra. Characteristics of the emission spectrum of atomic hydrogen. Interpretation of the spectrum using the relationship E=hv.
5.5 X-rays & atomic number.	Descriptive treatment in the light of Mosley's experiment.
5.6 Dual nature of electron.	Descriptive treatment of wave nature of electron.
5.7 Heisenberg's uncertainty principle.	Introductory non mathematical treatment.
5.8 Quantum numbers.	Brief non mathematical description of four quantum numbers.
5.9 Energy levels & Orbitals.	Shapes of s and p orbitals.
5.10 Electronic configuration of atoms.	Aufbau principle, Pauli's exclusion principle and Hund's rule. Writing of electronic configuration upto Z = 36.

Chapter-6

Chemical Bonding.

6.1 Energetic of bond formation.	Recall different types of bonds. Energy changes during the formation of a bond.

6.2 Ionization energy, electron affinity & electro negativity.	Description and explanation of variation of these properties with reference to periodic table.
6.3 Covalent bond.	Lewis theory, velence bond theory, VSEPR theory, Molecular orbital theory of diatomic molecules.
6.4 Bond energy, bond length and Dipole moment.	Brief and simple treatment of bond energy, bond length, bond polarity. Use of these properties to compare the reactivity of covalent bond.
6.5 Ionic and Covalent radii.	Concept and examples.
6.6 Effect of bonding on physical & chemical changes.	Describe & interpret the effect of different types of bonding on physical properties of compounds; Qualitative explanation of relative reactivities of ionic and covalent compounds.

Chapter-7

Thermo Chemistry Introduction

7.1 Spontaneous and Non-spontaneous reactions.	Explanation and examples of such reactions.
7.2 System, surrounding and state function.	Concept of the terms with examples.
7.3 Internal energy and first law of thermodynamics.	Statement mathematical form and the explanation of the terms involved $E = q_v$
7.4 Enthalpy	$\Delta H = q_p$ Experimental determination of enthalpy changes: Standard enthalpy changes of formation, combustion, hydration, solution and neutralization, lattice energy.
7.5 Hess's Law	Definition and applications (Born-habercycle, lattice energy) to determine enthalpy changes that can not be found experimentally.

Chapter-8

Chemical Equilibrium

8.1 Reversible reaction & phenomenon of dynamic equilibrium.	Concept and explanation. Law of mass action and writing equilibrium expressions (K_C K_b).
8.2 Applications of equilibrium expression	Prediction of direction and extent of a reaction with numerical examples.

8.3 Le-Chatelier's Principle.	Statement and explanation of the principle. Study of the effects of changes in concentration, temperature, pressure and the presence of catalyst on the reaction at equilibrium.
8.4 Acid-base equilibrium	Concept and mathematical form including pH, pOH, pK_w and common ion effect. Concept of buffer and buffer action with numerical examples.
8.5 Application of chemical equilibrium in industry.	Describe and explain the condition used in the production of ammonia and sulphur trioxide.
8.6 Solubility of sparingly soluble salts.	Solubility product and its calculation from solubility of the salt.

Chapter-9

Solutions

9.1 Concentration Units.	Recall percentage and molarity. Molality, mole fraction and parts per million.
9.2 Types of solutions.	Recall types of solutions. Solutions of liquids in liquids, vapour pressure-composition curve for an ideal mixture of liquids. Azeotropic mixtures. Solutions of solids in liquids. Fractional crystallization.
9.3 Colligative properties of solution.	Solubility and solubility curve. Lowering of vapour pressure of solvent by a solute, Raoult's Law. Measurement of elevation of boiling point and depression of freezing point.
9.4 Hydration and hydrolysis.	Concept and explanation.

Chapter-10

Electro Chemistry

10.1 Electrolytic conductance	Recall electrolytes and conductance. Examples of electrolysis like electrolysis of aqueous solution of NaCl, anodizing of Al, refinding of Cu.
10.2 Electrochemical cells	Description of Daniel Cell. Cell equations.
10.3 Electrode potential	Concept of electrode potential and standard electrode potential. Description of standard hydrogen and calomel electrodes. Determination of standard electrode potential of materials. Numerical examples.
10.4 Electrochemical series	Concept and explanation. Use of standard redox potential to predict the spontaneity of a reaction.
10.5 Oxidation state and balancing of equations	Concept. Finding out the oxidation states of atoms in compounds. Balancing of redox equations by oxidation number and ion electron methods.

10.6 Modern batteries and fuel cells	Working of rechargeable batteries and fuel cells.

Chapter-11

Reaction Kinetics

11.1 Rate of reaction.	Description of the terms rate of reaction, order of reaction, rate constant, half life of a reaction & rate determining step.
11.2 Determination of rate of reaction.	Physical & chemical methods.
11.3 Activation energy.	Concept and explanation.
11.4 Finding the order of reaction.	Illustrative examples involving path ways.
11.5 Effect of concentration & temperature on the rates of reaction.	Arrhenious equation: Description and explanation (Derivation not included)
11.6 Catalysis.	Homogeneous & heterogeneous catalyses. Enzymes as catalysts.

CHEMISTRY PART II

Content	Scope
Chapter-1	
The Basic Concept.	
1.1 Periodic classification of elements.	
1.2 Periodic table.	Description of long form of periodic table in temrs of periods, groups and block systematic.
1.3 Periodicity in physical properties.	Description of variation in atomic radius, ionic radius, melting point, metallic or non metallic character, oxidation states, electrical conductivity and heat of hydration. Explain qualitatively the variation in atomic radius, ionization energy, melting point and electrical conductivity.
1.4 Periodicity in chemical properties.	Characteristics of halides, oxides and hydrides.
1.5 Position of hydrogen	Description of position of hydrogen in the periodic table.
Chapter-2	
S-Block Elements.	
2.1 Introduction.	Names electronic configuration and occurrence. Peculiar behaviour of Lithium and Berylium.
2.2 Physical and chemical properties.	Difference of physical and chemical properties of 1^{st} and 2^{nd} group elements.
2.3 Commercial preparation of sodium and sodium hydroxide .	Trends in chemical properties of compounds like oxides, hydroxides, carbonates, nitrates and sulphates (Lithium, Sodium, Magnesium, Calcium) Down's and Nelson's cells.
2.4 Gypsum and Lime.	Role in agriculture and industry.
Chapter-3	
Groups-III and IV Elements.	
3.1 Introduction	Names, electronic configuration. Occurrence (Bone, Aluminum, Carbon, Silicon). Peculiar behaviour of boron and Carbon in their respective groups.
3.2 Compounds of Boron.	Preparation, properties and uses of borax and orthopedic acid.

3.3 Reactions of Aluminum.	Reactions with hydrogen, oxygen, halogens, acids and bases.
3.4 Compounds of Carbon and Silicon.	Structure and properties of oxides of carbon and silicon. Silicates, Silicones and their uses.
3.5 Uses.	Silicon and Germanium in semi conductor industries. Lead and in paints.

Chapter-4

Groups-V and VI Elements.

4.1 Introduction.	Names and electronic configuration. Occurrence (Nitrogen, Phosphorus, Oxygen, Sulphur)
4.2 Compounds of Nitrogen and Phosphorus.	Oxides of nitrogen & phosphorus. Halides of phosphorous, Oxyacids of nitrogen and phosphorous.
4.3 Comparison of oxygen and sulphur.	Similarities and dissimilarities.
Compounds of oxygen and sulphur.	Manufacture, properties and uses of sulfuric acid.

Chapter-5

The Halogens and Noble Gases.

5.1 Introduction.	Name, electronic configuration and occurrence. Peculiar behaviour of Fluorine and inert gases. Volatility of halides & its explantion in terms of Vander Waal's forces.
5.2 Oxidizing properties.	Relative reactivity of halogen as oxidizing agent.
5.3 Compounds of halogens	Hydrides, oxides and oxyacids. Comparative studies of hydrogen halides. Thermal stability of hydrides in terms of bond energies. Reactions of chlorine with hot and cold sodium hydroxide. Bleaching powder.
5.4 Uses.	Commercial uses of halogens and their compounds such as bleaches, refrigerants and in aerosols.
5.5 Compounds of noble gases.	Oxides, fluorides and oxyflourides of Xenon.

Chapter-6

The Transition Elements.

6.1 Introduction and General characteristics.	Definition, classification of transition elements and important general characteristics.

6.2 Electronic configuration and physical properties.	Electronic configuration and physical properties of d-block elements.
6.3 Manufacture of wrought iron and steel	Description of processes.
6.4 Corrosion & its prevention.	Description and chemistry of corrosion and its prevention.
6.5 Oxoions of chromium and manganese Complex Compounds.	Brief description of chromates, dichromates and permanganate ions. General introduction of complex compounds (central metal ion, ligand, coordination sphere, coordination number, chelates) Nomenclature of simple complexes. Geometrical shapes of complexes with coordination number 4,5 and 6.

Chapter-7

Fundamental Principles of Organic Chemistry.

7.1 Special features of organic chemistry	Special features of organic chemistry with reference to its ability to form chains, rings and isomers. Importance of organic chemistry in daily life.
7.2 Sources of Organic Compounds.	Coal, Petroleum and natural gas as sources of Carbon compounds and their prospects in Pakistan. Refining of petroleum. Reforming of petroleum. Reforming and cracking of hydrocarbons. Product information (tabular form).
7.3 Classification of Organic Compounds	Classification based upon carbon skeleton.
7.4 Functional Groups.	Definition with examples of common functional groups. Dependence of chemical properties and functional groups.
7.5 Isomerism (structural and cis-trans isomerism).	Definition, types of isomerism, brief description of structural and cis-trans isomerism with examples. Cis-trans isomerism arises due to retracted rotation of carbon-carbon double bond.
7.6 Hybridisation of Orbitals.	Non-mathematical description of sp^3, sp^2 and sp modes of hybridisation of carbon atom. Description of shapes of methane, ethane and ethyne molecules in terms of sigma and Pi bonds.

Chapter-8

Aliphatic Hydrocarbons.

8.1 Nomenclature.	Common names. Nomenclature based on I.U.P.A.C of aliphatic hydrocarbons.

8.2 Alkanes.	General methods of preparation, inertness of σ-bond, combustion, oxidation, nitration and halogenation. A brief mechanistic background to free radical substitution. Uses.
8.3 Alkenes.	General methods of preparation, reactivity of double bond, reaction including explanation of Markowink off addition, mechanism of electrophonic addition. Uses of ethane.
8.4 Alkynes.	General methods of preparation, reactivity of triple of triple bond, reactions, acidity of ethyne, uses of ethyne.
8.5 Comparison of reactivities	Comparison f reactivity's of Alkenes, Alkenes. and Alkynes.

Chapter-9

Aromatic Hydrocarbons. A brief introduction.

9.1 Nomenclature	Discussion limited to naming simple benzene derivatives.
9.2 Benzene	Structure (kekule and resonance), stability and methods of preparation.
9.3 Reactions.	General pattern of reactivity towards electrophiles. Addition, oxidation, electrophilic substitution (monousbstitution) and oxidation of side chain. Orientation in electrophilic substitution reactions and influence of the various groups on the reactivity of benzene. Comparison of reactivity's of Alkanes, Alkenes and Benzene.

Chapter-10

Alkyl Halides.

10.1 Nomenclature and classification	Introduction, naming limited to four carbon atoms.
10.2 Preparation.	Three common methods of preparation.
10.3 Reactivity of C-X bond	Brief description.
10.4 Reactions.	Nucleophilic substitution reactions (SN_1 and SN_2) general mechanistic details along with kinetics. Elimination reactions (E1 and E2): general mechanistic details.
10.5 Grignard's Reagent.	Preparation, reactivity of C-Mg bond, synthetic applications.

Chapter-11	
Alcohols, Phenols and Ethers.	Introduction Classification of alcohols.
11.1 Nomenclature of Alcohols.	Common and IUPAC names.
11.2 Industrial preparation of methanol and ethanol.	Simple description with reaction.
11.3 Reactivity of – OH group	Brief discussion.
11.4 Physical properties of alcohols & their uses.	Brief description.
11.5 Reactions of alcohols.	Reaction in which OH-bond is cleaved. Reaction in which C-O bond is cleaved. Distinction between primary-secondary and tertiary alcohols.
11.6 Preparation of phenol	Two common methods.
11.7 Acidic behaviour.	Relative acidity of water, phenol and ethanol.
11.8 Reactions.	Five common reactions including the reactions with formaldehyde.
11.9 Ethers & their nomenclature.	Introduction. Names of some common ether.
11.10 Preparations	Two methods of preparation of diethyl ether.
11.11 Physical & chemical properties.	Examplified by diethyl ether.

Chapter-12	
Aldehydes and Ketones.	Introduction.
12.1 Nomenclature.	Naming aldehydes and ketones up to four carbon atoms
12.2 Preparation.	One laboratory and one industrial methods for formaldehyde and acetaldehyde.
12.3 Reactivity of carbonyl group.	Brief discussion.
12.4 Reactions with mechanism.	Reactions of C = O with brief description of mechanism.
12.5 Identification of carbonyl compounds.	Detection tests for a aldehydes and ketones.

12.6 Uses	Uses of formaldehyde and acetaldyde.

Chapter-13

Carboxylic Acids and their Derivatives Introduction.

13.1 Nomenclature.	Simple carboxylic acids up to four carbon atoms.
13.2 Preparation.	Two laboratory methods and one industrial method for the preparation of acetic acid.
13.3 Reactivity of Carboxyl Group.	Brief discussion.
13.4 Physical properties.	Brief description.
13.5 Reaction with mechanism.	Preparation of four derivatives.
13.6 Amino acids.	Concept, examples and significance.

Chapter-14

Macromolecules.

14.1 Introduction.	Concept of polymerisation.
14.2 Synthetic polymers.	Addition and condensations, polymerisation. Brief description of polymers like polyvinyl chloride, polystyrene, polyvinyl acetate, polyester, polyamide and epoxy resins.
14.3 Life molecules.	Brief description of carbohydrates, lipids, proteins, enzymes and nucleic acids.

Chapter-15

Common Chemical Industries.

15.1 Fertilizers.	Brief description with reactions.
15.2 Cement.	Brief description with reactions.
15.3 Paper.	Brief description with reactions.

Chapter-16 **Environmental Chemistry.**	
16.1 Our Environment.	Introduction, components of environments and human interaction with environment.
16.2 Air Pollution-Some air pollutants.	Sources of carbon monoxide, sulphur dioxide, nitrogen oxides. Combustion of hydrocarbon based fuels.
16.3 The effects of polluted air on the environment.	The harmful effects of pollutants depend on their concentration and the duration of exposure to the pollutants. Acid Rain and smog. Advers effects of ozone in the lower stratosphere. Role of CFCs in destroying ozone in stratosphere.
16.4 Water Pollution- The causes of water pollution.	Livestock waste, oil spillages, pesticide, detergents in sewage and industrial effluents specially from leather and other chemical industries.
16.5 Water quality.	Preparation of potable water by separation of solid materials, precipitation by using Alums and purification by Chlorine.
16.6 Waste Management.	Plastic, paper and metals as solid waste. Effects of dumping waste at sea and in rivers. Dumping of solid waste for land filling and incineration. Treatment of industrial waste. Recycling of waste.

PRACTICALS FOR CLASS XI-XII

Important instructions to student in the laboratory.

i) Knowledge of precautions and laboratory safety.

ii) Knowledge of first aid and first aid kit.

iii) Familiarity with glass ware.

iv) Cutting and bending of glass tubes.

PRATICAL ACTIVIES

1. Separation of a mixture of inks by paper chromatograph.
2. Separation and identification lead and cadmium ions in a mixture solution by paper chromatography.
3. purification of commercial NaCl(common ion effect).
4. Crystallization of Benzoic acid from water.
5. Preparization and standardization of acid-alkali solution.
6. Determination of heat of neutralization.
7. Determination of Na_2CO_3 in a mixture solution.
8. Determination of Na H CO_3in a mixture solution.
9. Standardization of $KmnO_4$ solution by standard oxalic acid solution.
10. Determination of number of water molecules of crystallization in Mohr's salt and Ferrous sulphate.
11. Determination of acetic acid in vinegar.
12. Titration of iodine solution against sodium thiosulphate solution using starch solution indicator.

CLASS XII

1. Qualitative analysis of simple acid and basic radicals except insoluble and interfering radicals.
2. Estimation of Barium ions as Barium Chromate.
3. Detection of elements in an organic compound (N,S,Ha;gens).
4. Identification of the following functional groups in a simple organic compound.
   i) Carboxylic.
   ii) Phonetic.
   iii) Aldehydie.
5. Preparation of Aspirin, Iodoform, glucosazone and copper ammine complex.

INSTRUCTIONAL OBJECTIVES OF CHEMISTRY FOR CLASSES XI-XII

Chapter1

The Basic Concepts

1. The students will recall the difference between an atom, molecule, ion and molecular ion
2. The students will learn
   i. The scales of relative atomic masses of element
   ii. The determination of relative atomic masses by mass spectrometry
   iii. The concept of mole, Avogadro's number, molar volume and to apply these concept for stoichiometric calculation.
   iv. The concept of limiting reactant
   v. To calculate theoretical and percentage yields using balanced chemical equations.

Chapter 2

Experimental Techniques

i. The students will learn
ii. The concept and operation of filtration
iii. The concept and the process of crystallization
iv. The concept of sublimation
v. The concept of solvent extraction
vi. The concept and the principle paper chromatography.

Chapter 3

The Gases

1. The students will be able to compare the properties of three states of matter in terms of their physical behaviour and the types of intermolecular forces present in these states.
2. The students will learn
   i. How different laws govern the physical behaviour of gases
   ii. About the important postulates which formulate the kinetic model of gases,
   iii. The kinetic interpretation of temperature
   iv. Derivation of ideal gas equation and calculations based on it
   v. Ideal and non ideal behaviour of gases and vander Waal's explanation of non-ideal and behaviour
   vi. The concept of liquefaction of gases and critical temperature

vii. Brief concept of plasma and its properties.

Chapter 4

Liquids and Solids

The students will learn

i. The concepts of hydrogen bonding, dipole-dipole interaction and London dispersion forces and the effect of these forces on the physical properties of molecules

ii. The concepts of evaporation vapour pressure and boiling point and the methods to determine the vapour pressure of a liquid and effect of pressure on boiling point

iii. The energy changes accompanied by the phase changes

iv. Brief concept of liquid crystals

v. What are solids

vi. The different between crystalline and amorphous solids

vii. The concepts of unit cell, crystal lattice and lattice energy

viii. To classify solids on the basis of the dimensions of unit cell and the forces of attraction between their particles

ix. About the crystalline structure of important elements and compounds

x. How to calculate the Avogadro's number.

Chapter 5

Atomic Structure

The students will learn

i. How the sub atomic particles were discovered

ii. About the differences in properties of electron, proton and neutron

iii. About the various models of atom e.g. Rutherford's & Bohr's model

iv. How to interpret the spectrum of hydrogen using Bohr's model

v. How the concept of atomic number was developed

vi. About the wave nature of electron and how quantum number can be used to explain its physical behaviour

vii. About energy levels and the shapes of orbitals

viii. About the rules to distribute electrons in energy levels and sub-levels.

Chapter 6

Chemical bonding

The students will learn

i. The definition of a chemical bond and the energy changes accompanied by the formation of a bond

ii. About the thermodynamic properties of elements and the reasons of their variation in the periodic table

iii. About the various theories of covalent bond

iv. About the various properties of a bond and their effect on the reactivity

v. The relationship of the types of bonds and the physical properties

vi. How chemical changes are related to energy changes during the formation and breakage of bonds.

Chapter 7

Thermo chemistry

The students will learn

i. To describe the terms system, surrounding and state function

ii. The difference between spontaneous and non-spontaneous reaction

iii. To describe the meaning of internal energy and internal energy change

iv. To describe the meaning of enthalpy change in terms of exothermic and endothermic reactions

v. To derive equation $e=q_v$ and $H=q_p$ using 1^{st} law of thermodynamics.

vi. Hess's law and its applications.

Chapter 8

Chemical Equilibrium

The students will learn

i. About reversible reaction & phenomenon of equilibrium

ii. To write equilibrium constant expression using the concept of law of mass action(K_c,K_p)

iii. Apply equilibrium expression to predict the direction and extent of reaction

iv. The effect of variation of conditions on reaction at equilibrium with the help of Le-Chatlier's principle

v. Acid base equilibrium and its application in the terms of $_pH$, $_pOH$, $_pKw$, buffers and Buffer action, common ion effect

vi. The industrial application of the phenomenon of equilibrium

vii. The concepts of solubility product and common ion effect and their application.

Chapter 9

Solution

The students will recall the concentration units and the types of solution.

The Students will learn

i. The properties of solutions of liquids

ii. About the energy changes during the formation of a solution of solid on liquid

iii. The separation of solids by fractional crystallization

iv. The effect of solute on the vapour pressure of solvent in solution

v. How the elevation of boiling point and depression in freezing point are measured

vi. The difference between the hydration and hydrolysis.

Chapter 10

Electrochemistry

The students will learn

i. The phenomenon of electrolytic conductance

ii. The working of electrochemical cells and their application

iii. The concepts of electrode potential and standard electrode potential and to describe standard hydrogen and coloured electrodes and determine standard electrode potential of metals

iv. The concept of electrochemical series and to predict the spontaneity of the reaction

v. To calculate the oxidation state of an element in a compound

vi. To balance the chemical equations by oxidation number method

vii. To balancing the chemical equations by ion-electron method

viii. Working of rechargeable batteries and fuel cells.

Chapter 11

Reaction Kinetics

The students will learn

i. The concept of rate of reaction, rate constant and rate determining step

ii. To determine the rate of reaction by physical and chemical methods.

iii. The concept of activation energy

iv. To find out the order of reaction

v. The effect of concentration and temperature on the rate of reaction

vi. The phenomenon of catalysis.

CHEMISTRY PART II

Chapter 1

Periodic Classification of Elements

i. The students will learn

ii. To describe the periodic table in terms of groups and periods

iii. To describe and explain periodicity in physical and chemical properties

iv. To describe the position of Hydrogen in the periodic task.

Chapter 2

S-Block Elements

The students will learn

i. To write the electronic configuration of s-block elements in sequence

ii. The occurrence of 1^{st} and 2^{nd} group elements and the peculiar behaviour of lithium and beryllium

iii. The difference in the physical properties of 1^{st} and 2^{nd} groups elements as well as the difference in the chemical behaviour of their compounds

iv. The commercial preparations of sodium hydroxide

v. How is commercially preparation of sodium hydroxide

vi. The role of gypsum and lime in agriculture and industry.

Chapter 3

Groups III and IV Elements

The students will learn

i. The names, electronic configuration and occurrence of 3^{rd} & 4^{th} group elements

ii. The peculiar properties of boron and carbon in their respective groups

iii. The preparation and properties of Bora and orthoboric acid

iv. The reactions of aluminium

v. Structure and properties of oxides of carbon and silicone, silicates, silicones and their uses,

vi. The uses of silicon and Germanium semiconductor industries and lead in paints.

Chapter 4

Group V and VI Elements

The students will learn

i. The name and the electronic confrigution of 5^{th} and 6^{th} group elements

ii. The properties oxides and oxyacids of nitrogen and phosphorus halides

iii. To compare the properties oxides and oxygen and sulphur

iv. The manufacture, properties and uses of sulphuric acid.

Chapter 5

The Halogens and Noble Gases

The students will learn

i. Names, electronic configuration and the occurrence of halogens, the peculiar behaviour of thurine and inertness of noble gases

ii. The volatility of halides and its explanation in terms of vander Wall's forces

iii. The relatives re-activities of halogens as oxidizing agents

iv. The properties of hydrogen halides, oxides and oxyacids of halogens

v. The comparison of thermal stability of hydrides in terms of bond energies

vi. Reaction of chlorine with sodium hydroxide(hot\cold), bleaching powder

vii. The preparation and reactions of bleaching powder

viii. The commercial uses of halogen and their compounds as bleaches, refrigerants and aerosols.

ix. The properties of oxides, fluorides and oxy-fluorides of xenon.

Chapter 6

The Transition Elements

The students will learn

i. The definition and classification of transition elements

ii. The electronic configuration and the general characteristics like colour, magnetic and catalytic properties of the transition elements.

iii. The brief description of manufacture of wrought iron and steel from iron ore

iv. How corrosion is caused and ways to prevent it

v. The important methods of preparation of potassium chromate, potassium dichromate ad potassium permanganate and their important properties

vi. The definition of complex compounds and the elated terms like ligand, coordination number etc.

vii. The nomenclature and the geometrical shapes of simple complex compounds.

Chapter 7

Fundamental Principles of Organic Chemistry

The students will learns

i. The special features of carbon chemistry with reference to its ability to form chains, rings and isomers

ii. The importance of organic chemistry in daily life

iii. About the sources of carbon and its compounds like coal, petroleum and natural gas with reference to their availability in Pakistan.

iv. Refining, reforming and cracking of petroleum and enlist products in tabulated from.

v. How petroleum can serve as a source of different type of fuels.

vi. About the classification of organic compounds based on the carbon skeletons.

vii. About functional group the dependence of chemical properties on functional groups.

viii. About the structural iso merism in organic compounds

ix. That cis-tans isomerism arises due to restricted rotation around a carbon carbon double bond.

x. How the hybridisation theory can help us to understand the different types of bounding in organic compounds and their shapes.

Chapter 8

Aliphatic Hydrogen

The students will learn

i. To name the aliphatic hydrocarbons according to IUPAC rules

ii. The synthesis of alkanes, alkenes and alkynes and their important reactions

iii. The comparison of reactivity of 6 bond and π bond

iv. About the free radical nature of reactions of alkanes and electrophic addition of alkenes of alkynes

v. The comparison of reactivities of alkanes, alkenes.

Chapter 9

Aromatic Hydrocarbon

The students will learn

i. How to name simple aromatic hydrocarbons

ii. The kekule and resonance approaches to explain the structure of stability benzene

iii. About the preparation of benzene

iv. About the electrophilic substitution, oxidation and addition reactions of benzene

v. About the isomerism which arises when a second substituent enters the rings

vi. About the comparison of re-activities of Alkanes, Alkanes and Benzene

vii. How does the presence of group alters the reactivity of benzene ring for an electrophilic substitution reactions.

viii. The comparison of reactivities of alkanes, alkenes and benzene.

Chapter 10

Alkyl Halides

The students will learn

i. How to name an alkyl halide and to classify it into primary, secondary and tertiary alkyl halides.

ii. Simple ways of generating alkyl halides

iii. The reason why C-X bond in chemistry is one of the most reactive type

iv. The general mechanistic detail of nucleophilic substitution reactions and elimination reactions

v. The preparation of Grignard's reagent, the reactivity of C-Mg bond and its synthetic applications in organic chemistry.

Chapter 11

Alcohols, Phenols and Ethers

The students will learn

i. How to name simple monohydric and polyhadric alcohols and their classification as primary, secondary and tertiary alcohols

ii. The important synthetic reactions leading to alcohols and industrial process for the commercial manufacture of methanol and ethanol

iii. The nature of OH group and its reactivity when O-H bond is broken and when C-O bond is broken

iv. To distinguish chemically between the primary, secondary and tertiary alcohols

v. The concept of phenols and to understand their acidic nature and two methods for their preparation

vi. The importance of Phenols as starting material for the preparation of five industrially important compounds

vii. How to name ethers preparation of diethyl ether (two methods)

viii. The physical and chemical behaviour of diethyl ether and its inertness towards chemical reagents.

Chapter 12

Aldehydes and Ketons

The students will learn

i. How to name aldehydess and ketones up to four carbon atoms

ii. General methods for the preparation of aldehydes and ketones

iii. How are formaldehydes and acetaldehydes commercially prepared

iv. The relationship between structure and reactivity of carboxyl group

v. The reactions of aldehydes and ketones with mechanism

vi. How to identify aldehydes and ketons

vii. The tests for distinction between aldehydes and ketones.

Chapter 13

Carboxylic Acids and their Derivatives

The students will learn

i. How to name carboxylic acids and their derivatives

ii. The commercial method for the preparation of acetic acid

iii. The relationship between the structure of carboxyl group and its reactivity

iv. The effect of hydrogen bonding on the physical properties of carboxylic acids

v. The ways of preparing four derivatives of carboxylic acids and the conversion of these derivatives back to carboxylic acids

vi. About amino acids and their significance.

Chapter 14

Chemical Industries

The students will learn a brief survey of the process along with flow sheet diagram and the reaction involved in the important industries like Fertilizers, Cement and paper.

Chapter 15

Macro molecules

The student will learn

i. The concept of polymerisation and macromolecules

ii. Types of polymerization and product of these polymerization e.g. polyvinyl chloride, polystyrene, polyvinyl acetate, poly amids, polyester and epoxy resins

iii. About life molecules as carbohydrates, lipids, protein, enzymes and nucleic acids.

Chapter 16

Environmental Chemistry

The students will learn

i. The meaning of environmental pollution

ii. The sources of air pollutants like CO, SO_2, oxides of nitrogen etc

iii. Effects of polluted air on environment

iv. The causes of water pollution

v. The preparation of potable water

vi. About the solids waste and its management like dumping and incineration, treatment of industrial waste and recycling of solids waste.

ESTIMATED TIME ALLOCATION AND WEIGHTAGE FOR VARIOUS CHAPTERS

CHEMISTRY XI

THEORY PERIODS

Chapter No.	Content	Periods	Weightage
1.	The basic concepts	14	7%
2.	Experimental techniques in chemistry	8	4%
3.	The gases.	12	6%
4.	Liquids and Solids	16	8%
5.	Atomic structure	18	9%
6.	Chemical bonding	18	9%
7.	Thermo Chemistry	10	5%
8.	Chemical Equilibrium	14	7%
9.	Solutions	14	8%
10.	Electrochemistry	16	8%
11.	Reaction Kinetics	10	5%
	Total	**150**	**75%**

Practical	**60**
Grand Total	**180**

ESTIMATED TIME ALLOCATION AND WEIGHTAGE FOR VARIOUS CHAPTERS

CHEMISTRY XII

THEORY PERIODS

Chapter No.	Content	Periods	Weightage
1.	Periodic classification of elements	12	6%
2.	S-Block elements	8	4%
3.	Group III and IV elements	8	4%
4.	Group V and VI elements	10	5%
5.	The halogens and noble gases	10	5%
6.	The transition elements	12	6%
7.	Fundamental principles of organic chemistry	10	5%
8.	Aliphatic hydrocarbons	10	5%
9.	Aromatic hydrocarbons	8	4%
10.	Alkyl halides	8	4%
11.	Alcohol, phenols and ethers	10	5%
12.	Aldehydes and ketones	8	4%
13.	Carboxylic Acids and their derivatives	6	3%
14.	Macromolecules	8	4%
15.	Common chemical industries	8	4%
16.	Environmental chemistry	14	7%
	Total	**150**	**75%**

Practical	150
Grand Total	300

Chemistry XI-XII

General Instructions to Authors.

An important step in the development of the curriculum is to explain the contents keeping in view of the scope at the proper cognitive level of the students. It is highly appreciative task to assist both teachers and students in learning and transmission of the life experiences. The topic must be motivated by its relevance to the application of basic principles and laws. The concept to be introduced be explained informally before providing the formal definition along with the tangible example form the real life situation. Keeping this strategy in view the authors should observe the following points while writing the books.

1. Learning objectives expected to be achieved in each chapter should be prominently stated at the beginning of the chapter.
2. The concept should be introduced in the beginning with proper repetition of aspects of the concept learned in previous classes.
3. The details of the treatment of the subject should be properly classified into headings and subheadings.
4. Scientific terms and definition should be bold faced in the text.
5. The language used in the text should be concise, easily understandable and straight-forward.
6. photographs and illustrations should be clear, labelled and supportive of the text
7. To stimulate the interest of the students, the examples and applications should be from every day life.
8. S.I units should be used throughout .Numerical values of the constants should be same,
9. solved numerical example and end of chapter problems should be based on variety of situations and be related to local environment and culture The end of chapter exercise should start form simple questions increasing the complexity gradually The last few problem should encourage the students to study the concept in detail from a reference book .These questions should test knowledge, understanding and skills.
10. All question should be very appropriately and clearly worded.
11. Boxed highlight should provided additional information about the concepts. A brief note about the concerned scientist's achievements and life sketch may also be included.
12. Tables and flow charts may be given wherever appropriate.
13. Coherent and precise summary should be given at the end of each chapter.
14. A comprehensive glossary of terms and index should be given at the end of the book.
15. The teacher's guide should also be developed along with the textbook which should contain instructions how to explain a topic and how to perform a relevant activity.
16. A Practical manual for the students should also be written to support the practical work.

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