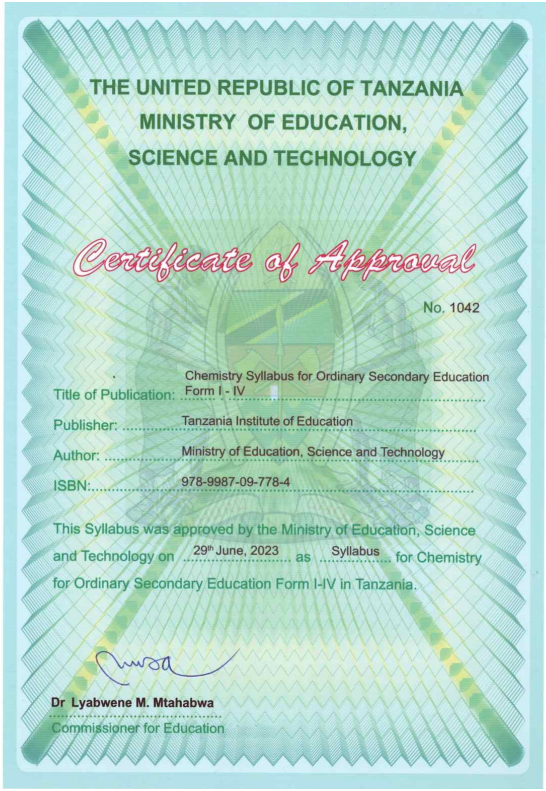
THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY



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Commissioner for Education

CHEMISTRY SYLLABUS FOR ORDINARY SECONDARY EDUCATION FORM I–IV

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Abbreviations and Acronyms

ICT	Information and Communication Technology
IUPAC	International Union of Pure and Applied Chemistry
MoEST	Ministry of Education, Science and Technology
MO	Methyl orange
NECTA	The National Examinations Council of Tanzania
POP	Phenolphthalein
TIE	Tanzania Institute of Education

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Finally, TIE thanks the Ministry of Education, Science and Technology in a special way for facilitating the preparation and distribution of this syllabus.

Dr Aneth A Komba
Director General
Tanzania Institute of Education

1.0 Introduction

Chemistry is a compulsory subject for form I-IV students in General Education pathway who choose to join one of the following streams at Ordinary Secondary Education: Science, Agriculture, Food and human nutrition and ICT. However, it is an elective subject to other streams. The purpose of learning Chemistry at this level is to understand and obtain skills on the composition, structure, and properties of matter and the changes which different matter undergo under different conditions. Studying this subject give the understanding on the fact that chemistry plays key roles in everyone life and touches almost every aspect in our existence and meet our crucial needs such as food, health, shelter, water, clean air, energy and manufactured products. Thus, Chemistry is useful for preparing the student for the real world. It is also serves as a bridge to enable the student to appreciate the values of resources present in Tanzania and develop the ability to explore them and create works for self-employment.

This syllabus is designed to guide the teaching and learning of Chemistry for Ordinary Secondary Education Form I–IV in the United Republic of Tanzania. The syllabus interprets the competences indicated in the 2023 Ordinary Secondary Education Curriculum. It provides information that will enable teachers to plan their teaching process effectively. It also provides teaching and learning opportunities that guide teachers to apply different methods and strategies to promote students' scientific and ICT skills and develop 21st century skills which include critical thinking, creativity, communication, collaboration and problem solving.

2.0 Main Objectives of Education in Tanzania

The main objectives of education are to enable every Tanzanian to:

(a) Develop and improve his or her personality so that he or she values himself or herself and develops self-confidence;

(b) Respect the culture, traditions and customs of Tanzania; cultural differences; dignity; human rights; attitudes and inclusive actions;

(c) Advance knowledge and apply science and technology, creativity, critical thinking, innovation, cooperation, communication and positive attitudes for his or her own development and the sustainable development of the nation and the world at large;

(d) Understand and protect national values, including dignity, patriotism, integrity, unity, transparency, honesty, accountability and the national language;

(e) Develop life and work-related skills to increase efficiency in everyday life;

(f) Develop a habit of loving and valuing work to increase productivity and efficiency in production and service provision;

(g) Identify and consider cross-cutting issues, including the health and well-being of the society, gender equality, as well as the management and sustainable conservation of the environment; and

(h) Develop national and international cooperation, peace and justice per the Constitution of the United Republic of Tanzania and international conventions.

3.0 Objectives of Ordinary Secondary Education

The objectives of Ordinary Secondary Education-General Education are to:

(a) Strengthen, broaden and develop a deeper understanding of the knowledge, skills and attitudes developed at the Primary Education level;

(b) Safeguard customs and traditions, national unity, national values, democracy, respect for human and civil rights, duties and responsibilities associated with such rights;

(c) Develop self-confidence and the ability to learn in various fields, including science and technology as well as theoretical and technical knowledge;

(d) Improve communication using Tanzanian Sign Language (TSL), tactile communication, Kiswahili and English. The student should be encouraged to develop competence in at least one other foreign language, depending on the school situation;

(e) Strengthen accountability for cross-cutting social issues, including health, security, gender equality and sustainable environmental management and conservation;

(f) Develop competence and various skills which will enable the student to employ himself or herself, to be employed and to manage his or her life by exploiting his or her environment well; and

(g) Develop readiness to continue to advance secondary and tertiary education.

4.0 General Competences for Ordinary Secondary Education

The general competences for Ordinary Secondary Education-General Education are to:

(a) Use the knowledge and skills acquired in the Primary Education to strengthen and expand academic understanding;

(b) Value citizenship and national customs;

(c) Demonstrate confidence in learning various professions including science and technology, theoretical and technical knowledge;

(d) Use language skills including Tanzania Sign Language (TSL), Kiswahili, English and at least one other foreign language to communicate;

(e) Use knowledge of cross-cutting issues to manage the environment around them; and

(f) Use knowledge and skills to enable a student to be self-employed, employable and manage life, and conserve the environment.

5.0 Main and Specific Competences of the Subject

The main and specific competences to be developed in Chemistry are presented in Table 1.

Table 1: *Main and Specific Competences for Form I–IV*

Main competences	Specific competences
1.0 Demonstrate mastery of basic concepts, theories and principles in Chemistry	1.1 Demonstrate mastery of concepts, theories and principles in Chemistry 1.2 Demonstrate an understanding of the physical and chemical properties of elements on the basis of their arrangements in the periodic table
2.0 Demonstrate mastery of basic terminologies in Chemistry	2.1 Use the International Union of Pure and Applied Chemistry nomenclature to name chemical species 2.2 Use chemical symbols, formulae and equations to represent chemical reactions
3.0 Conduct experiments in Chemistry	3.1 Conduct experiments in Chemistry
4.0 Demonstrate mastery of basic principles of extraction of metals	4.1 Demonstrate mastery of the principles of extraction of metals
5.0 Conduct a project in Chemistry	5.1 Conduct a project in Chemistry

6.0 Roles of Teachers, Students and Parent in Teaching and Learning Processes

A good relationship between the teacher, student and parent/ guardian is fundamental to ensuring successful teaching and learning. This section outlines the roles of each participant in facilitating effectively teaching and learning of Chemistry subject as follows:

6.1 The teacher

The teacher is expected to:

(a) Help the student to learn and acquire the intended competences in Chemistry;

(b) Use teaching and learning approaches that will allow students with different needs and abilities to;

  (i) develop the competences needed in the 21st century;

  (ii) actively participate in the teaching and learning process.

(c) Use student centred instructional strategies that make the student a centre of learning which allow them to think, reflect and search for information from various sources.

(d) Create a friendly teaching and learning environment;

(e) Prepare and improvise teaching and learning resources;

(f) Conduct formative assessment regularly by using tools and methods which assess theory and practice.

(g) Treat all the students equally irrespective of their differences;

(h) Protect the student while at school;

(i) Keep track of the student's daily progress;

(j) Identify individual student's needs and provide the right interventions;

(k) Involve parents/guardians and the society at large in the student's learning process; and

(l) Integrate cross-cutting issues and ICT in the teaching and learning process.

6.2 The student

The student is expected to:

(a) Develop the intended competences by participating actively in various learning activities inside and outside the classroom; and

(b) Participate in the search for knowledge from various sources, including textbooks, reference books and other publications including online resources such as electronic libraries.

6.3 The parent

The parent/guardian is expected to:

(a) Monitor their child's academic progress;

(b) Where possible, provide the child with the needed academic support;

(c) Provide the child with a safe and friendly home environment which is conducive for learning;

(d) Keep track of the child's progress in behaviour;

(e) Provide the child with any necessary materials required in the learning process; and

(f) Instil in the child a sense of commitment and positive value towards education and works.

7.0 Teaching and Learning Methods

The teaching and learning methods are instrumental in developing student's competences. This syllabus suggests teaching and learning methods for each activity which includes but not limited to discussions, presentations, field visits, practical work, research, scientific experiments, and project works. However, a teacher is advised to plan and use other appropriate methods based on the environment or context. All the teaching and learning methods should be integrated with the everyday lives of students.

8.0 Teaching and Learning Resources

The process of teaching and learning of Chemistry require different resources. In that regard, both the teacher and students should work together to collect or improvise alternative resources available in the school and home environment when needed. The teacher and student are expected to constantly seek for information from various sources in order to effectively facilitate teaching and learning process. The list of approved textbooks and reference books shall be provided by TIE.

9.0 Assessment

Assessment is important in teaching and learning of Chemistry subject. It is divided into formative and summative assessments. Formative assessment informs both the teacher and students on the progress of teaching and learning, and in making decisions on improving the teaching and learning process. Teachers are, therefore, expected to apply a wide range of formative assessment methods which include but not limited to discussions, presentations, oral questions, experiments, observations, practical and projects.

Summative assessment, on the other hand, will focus on determining student's achievement of learning. Teachers are expected to use a variety of summative assessments including mid-term tests, terminal, mock examinations and

projects. The scores obtained from these assessments will be used as Continuous Assessment (CA). Therefore, the continuous assessments shall contribute 30% and the National Form IV Examination shall be 70% of the student's final achievement, as indicated in Table 2.

Table 2: *Contribution of Continuous Assessment and National Examination in the final score*

Assessment Measures	Weight (%)
Standard VI National Examination	7.5
Form II National Examination	7.5
Form III Terminal Examination	5
Form III Project	5
Form IV Mock Examination	5
Form IV National Examination	70
Total	**100**

10.0 Number of Periods

The Chemistry Syllabus for Ordinary Secondary Education provides estimates of the time that will be spent in teaching and learning, in consideration of the complexity of the specific competences and the learning activities. Three periods in a week for Form I–II and four periods in a week for Form III–IV have been set aside for this subject, each period is 40 minutes.

11.0 Teaching and Learning Contents

The contents of this syllabus are presented in matrix form with seven columns which include main competences, specific competences, learning activities, suggested methods, assessment criteria, suggested resources and periods as presented in Table 3–6.

Form I

Table 3: *Detailed Contents for Form I*

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
1.0 Demonstrate mastery of basic concepts, theories and principles in Chemistry	1.1 Demonstrate mastery of concepts, theories and principles in Chemistry	(a) Describe the concept of Chemistry (*meaning, branches, applications and relationships with other disciplines*)	**Brainstorming:** Assign students in manageable groups to brainstorm on chemical basis of materials from their environment, give the meaning of Chemistry and justifying the reason for studying Chemistry **Project works:** Guide students to explore the common industrial products in Tanzania and relate their applications to the importance of Chemistry	The concept of Chemistry is clearly described	Pictures, diagrams, simulations, animations or videos illustrating the meaning, branches, applications and relationship with other disciplines	78

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Discuss the contribution of Chemistry in the development of modern society	**Field visit:** Guide students to visit any nearby industry, health facilities, mining sites and agricultural farms to appreciate the importance of Chemistry in the development of societies	The contribution of Chemistry in the development of modern society is clearly recognised	Simulations, animations or videos illustrating the contribution of Chemistry in the development of modern society	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(c) Describe the concept of matter (*physical and chemical changes of matter*)	**Practical work:** Guide students to carry-out hands-on activities to investigate the physical and chemical changes of matter using samples of substances found in their environment **Experimentation:** Guide students to perform experiments basing on sublimation of compounds, rusting of iron nails, freezing and evaporation of water and dissolving of salts using distilled water	The concept of matter is clearly described	Ice, water, source of heat, evaporating basin, metal nails,beaker, table salt, sugar, iodine crystals, magnet, magnesium ribbon, acids, fruits, paper, $CuSO_4$ solution, aluminium foil, candle, $CaCO_3$, $Pb(NO_3)_2$ solution and simulations and videos illustrating physical and chemical changes of matter	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(d) Describe the concepts of chemical elements (*criteria for assigning chemical symbols*), compounds (*binary compound*) and mixtures (*types of solution and separation of mixtures*)	**Think-ink-pair-share:** Guide students in pairs to think and share about various types of industrial products they commonly use in their home for various activities, reflect on their constituent elements and explain the meaning of element, compound and mixture **Hands-on-minds-on:** Assign students to prepare solutions using materials available in their home settings and reflect their properties to practices of using them in various applications such as pharmaceuticals and domestic activities	The concepts of chemical elements, compounds and mixture are clearly described	Periodic table, copper, zinc, aluminium, iron, sulphur, hydrogen, common salt, iron filings, magnet, powdered sulphur, crucible and lid, heat source, HCl solution, water, chalk FeS, milk, clay soil,	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(e) Compare the properties of compounds with those of constituent elements	**Group discussion:** Guide students in manageable groups to explore the properties of chemical compounds useful in real-life situation **Technological -based learning:** Guide students to analyse features of compounds and element from real substances using visual aids	The properties of compounds are correctly compared with those of constituent elements	margarine, filter paper, funnel, ethanol, iodine crystals, kerosene, ink, sugar, wall charts, and pictures of distillers	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(f) Explain the concept of the periodic table (*1st 20 elements in the Periodic Table; metals and non-metals*)	**Outdoor activity:** Assign students to collect materials in their environment and classify into metals and non-metals **Project works:** Assign students to carry-out project task to investigate on different properties of metals and non-metals available in their real life setting and write a report	The concept of the periodic table is clearly explained	Diagrams, pictures, wall charts, simulations and videos illustrating 1st 20 elements in the Periodic Table; metals and non-metals	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
2.0 Conduct experiments in Chemistry	2.1 Conduct experiments in Chemistry	(a) Describe basic Chemistry laboratory skills (*chemistry laboratory rules and safety measures, first aid, fire and firefighting, and Chemistry laboratory apparatus*)	**Group discussion:** Guide students in manageable groups to interpret basic laboratory skills related to rules and precautions, safety measures and chemical warning signs **Guest speaker from fire brigade:** Guide students to interpret classes of fire and practice on firefighting basing on speaker's instructions and write a report **Outdoor activity:** Guide students to practice on extinguishing small fires	Basic Chemistry laboratory skills are clearly described	Laboratory manuals, models, pictures, wall charts with written laboratory rules, first aid kit, laboratory apparatus, fire extinguishers and videos illustrating basic chemistry laboratory skills	39

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Perform experiments on the changes of matter from one state to another	**Experimentation:** Guide students to perform experiments on various materials from the environment and laboratory, and use chemicals to demonstrate changes of matter	Experiments on the changes of matter from one state to another are correctly performed	Ice, water, iron chips, heat source, clay soil, margarine, filter paper, funnel, iodine crystals, anhydrous $CuSO_4$ kerosene, salt and sugar	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(c) Perform experiments on separation of different mixtures using different methods	**Home-based project:** Assign students to carry-out simple experiments on separating mixtures in their daily life **Experimentation:** Guide students to perform experiments on separating mixtures basing on specific properties of substances such as solubility and boiling point **Questions and answers:** Guide students to present the common and commercial applications of the various methods for separating mixtures, for examples simple distillation, fractional distillation and decantation	Experiments on separation of different mixtures using different methods are correctly performed	Common salt, iron filings, magnet, powdered Sulphur, crucible and lid, heat source, HCl solution, FeS, milk, clay soil, margarine, kerosene, filter paper, funnel, ethanol, kerosene, ink, sugar, distillation system and animations or videos illustrating separation of different mixtures using different methods	

Form II

Table 4: *Detailed Contents for Form II*

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
1.0 Demonstrate mastery of basic concepts, theories and principles in Chemistry	1.1 Demonstrate mastery of concepts, theories and principles in Chemistry	(a) Describe the modern concept of atomic structure (*Dalton's atomic structure and sub-atomic particles*)	**Think-ink-pair-share:** Guide students in pair to think about the meaning of an atom and its structure **Technological-based learning:** Guide students to account for the structure of an atom basing on ICT facilities and write a report	The modern concept of atomic structure is clearly described	Diagrams, pictures, wall charts, simulations and videos illustrating Dalton's atomic structure and sub-atomic particles	81

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Describe the concept of electronic arrangements	**Technological-based learning:** Guide students to watch visual aids for simulations and animations, showing the arrangements of electrons in atoms of elements in their shells and write a report **Group activity:** Assign students in manageable groups to practice the arrangement of electrons in shells of atoms of different elements through models designing using locally available materials	The concept of electronic arrangements in atoms is clearly described	Diagrams, pictures, wall charts, simulations and videos illustrating energy shell diagram, and locally available materials for designing electronic models	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(c) Use the concept of atomic structure to determine the atomic and mass numbers of an element	**Group discussion:** Guide students in manageable groups to calculate the atomic number and mass number of an element for the given compound	Atomic numbers and mass numbers of elements are correctly determined	Models, charts and pictures showing the atomic number of elements, and wall charts showing the number of protons and neutrons of elements	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(d) Explain the concept of chemical formulae and nomenclature (*valence*, *oxidation state, radicals and naming of binary inorganic compounds using the IUPAC system*)	**Inquiry-based learning:** Assign students to collect commonly used substances and give their common names and identify their constituent elements **Group discussion:** Guide student in manageable groups to describe the concepts of chemical formula, valence, oxidation state, radicals and name binary inorganic compounds using the IUPAC system **Gallery work:** Guide students to brainstorm and share key rules in writing chemical formulae	The concept of chemical formulae and nomenclature are clearly explained	Valence cards, modern periodic table, wall charts showing oxidation states and common radicals, and labelled bottles containing different laboratory chemicals	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(e) Determine empirical and molecular formulae of common compounds	**Group discussion:** Guide students in manageable groups to determine percentage compositions of each element and in a compound **Problem solving:** Guide students to apply steps for calculating empirical formulae and molecular formulae of different compounds	Empirical formulae and molecular formulae of different compounds are correctly determined	Model depicting empirical formulae and molecular formulae, wall charts showing molecular fomulae and modern periodic table	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(f) Describe the concept of chemical bonding (*covalent and electrovalent bonding*)	**Outdoor activity:** Guide students to reflect on real-environment about bonding such as building blocks erecting a walls and relate with the concepts of bonding **Technological-based learning:** Use software such as ChemDraw to demonstrate the process of bonding	The concept of chemical bonding is clearly described	Selected organic and inorganic structures, Computers installed with Chemistry software	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(g) Describe the concept of chemical reactions (*chemical equations, balancing chemical equations, and types of chemical reactions*)	**Group discussion:** Guide students in manageable groups to write simple word equations and chemical equations with symbols **Think-ink-pair-share:** Guide students in pairs to identify types of chemical reactions, balance chemical equations, interpret word equations into chemical equations **Experimentation:** Guide students to perform an experiment to verify the law of conservation of matter and write the report	The concept of chemical reactions is clearly described	Kerosene, candles, KOH/NaOH, HCl, glycerine, selected apparatus and equipment	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(h) Relate the types of chemical reactions with common processes in daily life such as burning of fuel and digestion in living organisms	**Project works:** Task students to carry-out project to examine applications of chemical reactions in the burning of fuel and digestion in living organisms	The types of chemical reactions are clearly related with common processes in daily life	Laboratory note book, heat source and fuel such as charcoal	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(i) Describe acids, bases and salts (*reactions of acids and bases with various substances*) and their applications in daily life	**Inquiry-based learning:** Guide students to analyse various substances with acidic and basic properties commonly found in their environment and describe the concepts of acids, bases and salts **Group discussion:** Guide students in manageable groups to describe the reactions of acids and bases **Field trips:** Guide students to visit nearby food and beverages processing industries to examine the applications of acids, bases and salts	The concepts of acids, bases and salts are clearly described	Citrus fruits, vinegar, sour milk, apples, wood ash, tooth paste, baking powder, mineral acids, hydroxides and indicators	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
	1.2 Demonstrate an understanding of the physical and chemical properties of elements on the basis of their arrangements in the periodic table	(a) Explain the changes in the physical and chemical properties of elements across and down the periodic table	**Group discussion:** Guide students in manageable groups to explain the trends of metallic and non-metallic elements across the periods and down the groups of the periodic table	Changes in properties of elements across and down the periodic table are correctly explained	Diagrams, pictures, wall charts, simulations and videos illustrating changes in the physical and chemical properties of elements across and down the periodic table	18
		(b) Use the electronic configuration of an element to locate their positions in the periodic table	**Group discusion:** Guide students in manageable groups to apply the periodic law in locating elements in the periodic table	The electronic configurations of elements are correctly used to locate the positions of elements in the periodic table	Wall charts of modern periodic table showing electronic configuration of some elements	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
2.0 Conduct experiments in Chemistry	2.1 Conduct experiments in Chemistry	(a) Prepare acid- base indicators using locally available materials	**Outdoor activity:** Guide students to prepare acid- base indicators from locally available materials and write reports	Acid-base indicators are correctly prepared using locally available materials	Coloured flowers, coloured leaves, mortar and pestle, pieces of clothes, heat source, tripod stand lemon juice, tomato juice, sour milk, vinegar, soft drinks and NaOH	18

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Use the prepared indicators to test acidity and alkalinity of substances found in the locality	**Experimentation:** Guide students to perform experiments using locally made indicators to test acidity and alkalinity of subtances found in the locality	Acidity and alkalinity of substances found in the locality are tested using the prepared indicators	Locally prepared indicator, POP indicator, MO indicator, lemon juice, tomato juice, sour milk, vinegar and soft	

Form III

Table 5: *Detailed Contents for Form III*

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
1.0 Demonstrate mastery of basic concepts, theories and principles in Chemistry	1.1 Demonstrate mastery of concepts, theories and principles in Chemistry	(a) Describe the mole concept (*comparison of the mole with other units of measurements and molar quantities of substances*)	**Outdoor learning:** Assign students to visit nearby shops to explore items that are sold in units such as water in catorns, pair of shoes and other quantities and describe the concept of mole and molar quantities of substances **Classroom assignments:** Assign students to work on calculations and conversions of masses and volumes of substances to moles and vice versa	The mole concept is clearly decribed	Analytical balance, different chemicals, and videos, animations, simulations, pictures/ wall, charts illustrating the molar mass of elements	68

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Explain Avogadro's law in relation to molar quantities	**Group discussion:** Guide student in manageable groups to use the Avogadros Law in explaining the molar quantities	The Avogadro's Law is clearly explained and correctly applied in calculating molar quantities	Scientific calculator and analytical balance	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(c) Explain the principles of volumetric analysis (*preparation of standard solutions and volumetric calculations*)	**Brainstorming:** Assign students to brainstorm on the concept of volumetric analysis **Project works:** Guide students to carry-out a visit to nearby possible industries eg. Foods, drinks, cosmetics and pharmaceuticals industries to analyse procedures for determining amounts of chemical substances. **Group discussion:** Guide students in manageable groups to perform volumetric calculations and make classroom presentations	The principles of volumetric analysis are clearly explained	Analytical balance, pipette, burette, volumetric flasks, beakers, distilled water, petri dish, watch glass, funnels, wash bottles, HCl, H_2SO_4, HNO_3, CH_3COOH, NaOH, $Ca(OH)_2$, Na_2CO_3, $NaHCO_3$	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(d) Describe the applications of volumetric analysis in real life and industrial settings as in soft drinks and cocktail making, medicine and in agriculture	**Experimentation:** Guide students to perform experiments related to the applications of volumetric analysis	The applications of volumetric analysis in real life and industrial settings are clearly described	Pipettes, burettes, volumetric flasks, beakers, distilled water, petri dish, watch glass, funnels, wash bottles, backing powder, vinegar, processed juice, antacids tablets and suspensions, fertiliser, NaOH, HCl, H_2SO_4 , HNO_3, CH_3COOH, $Ca(OH)_2$, Na_2CO_3 and $NaHCO_3$	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(e) Explore the basic tenets of ionic theory and electrolysis (*ionic theory, mechanism of electrolysis and laws of electrolysis*)	**Group discussion:** Guide students in manageable groups to describe the concept of ionic theory and electrolysis and make presentations **Experimentation:** Guide students to carry-out experiments that demonstrate the mechanism of electrolysis using simple available chemicals and apparatus **Field Trip:** Guide students to carry-out fields trips to near by industries involved in extraction, electroplating and purification of metals and examine the applications of electrolysis	The basic principles of ionic theory and electrolysis are clearly described	Electrolytic cells, pencils, battery (dry cells), connecting wire, distilled water, acid, H_2SO_4, $CuSO_4$, $ZnSO_4$, NaCl, KCl, and simulations or videos, diagrams, pictures, wall charts, illustrating principles of ionic theory and electrolysis	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(f) Describe the preparation and properties of various compounds of metals (*oxides, hydroxides, carbonates, hydrogen carbonates, nitrates, chlorides and sulphates of metals*)	**Inquiry-based learning:** Guide students to investigate properties of compound of metals and relate with extraction of metals, making of paints, textiles, drinking water, soaps, and detergents	The preparation and properties of various compounds of metals are clearly described	Periodic table, lead metal, iron strips, magnesium nitrate, zinc sulphate, lead nitrate, copper sulphate, silver nitrate, magnesium ribbon, aluminium foil, laboratory glassware, water trough, flasks, gas jars, kipps apparatus, combustion tube, heat sources, hydrochloric acid, sulphuric acid and the first 20 elements of the periodic table	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(g) Describe the oxidizing and displacement properties of non-metal compounds (*oxygen, hydrogen, chlorine, hydrogen chloride, sulphur dioxide, nitrogen, ammonia, and carbon dioxide*)	**Group discussion:** Guide students in manageable groups to describe the properties of non-metals and write report **Project works:** Guide students to carry-out visits to nearby industries for making gases, pesticides, fertilisers and other chemicals, analyse properties of the compounds of non-metals	Oxidizing and displacement properties of non-metal compounds are clearly described	Wall charts and pictures showing some important oxidation reactions, periodic table, oxygen gas, hydrogen gas, chlorine gas, hydrogen chloride gas, sulphur dioxide gas, nitrogen gas, ammonia gas, carbon dioxide gas, coloured flower, dyes, hydrogen sulphide, Iron(II) chloride, potassium dichromate and potassium permanganate	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
2.0 Conduct experiments in Chemistry	2.1 Conduct experiments in Chemistry	(a)Perform experiments on volumetric analysis	**Experimentation:** Guide students to perform titrations for various standard solutions **Field trips:** Guide students to execute a field trips to nearby industries mainly concerned with quantification of species in different substances and write a report for assessment	Experiments on volumetric analysis are performed correctly	Analytical balance, pipette, burette, volumetric flasks, beakers, distilled water, laboratory glassware, funnels, wash bottles, NaOH, HCl, H_2SO_4, HNO_3, CH_3COOH, $Ca(OH)_2$, Na_2CO_3 and $NaHCO_3$	58

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Perform experiments on the applications of electrolysis in corrosion inhibition and purification of metals	**Experimentation:** Guide students to investigate the applications of electrolysis in the electroplating process for common items in the environment	Experiments on the applications of electrolysis in corrosion, inhibition and purification of metals are correctly performed	Graph papers, sand papers, dry cells Li-ion (3 V &6 V), Lead acid cells (12 V, 5 Ah-7 Ah), Sulphuric acid, copper(II) sulphate, copper ores and sheets, spoon, copper wires, sodium chloride, graphite rods plate, aluminium ores, gold, zinc, impure copper plates, chloride/ sulphate, iron plates, distilled water, potassium dichromate, coulometer, pure copper rods, ammeter, voltmeter, and 100 mL and 250 mL beakers	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(c) Use appropriate software to sketch the set-ups of experiments	**Experimentation:** Guide students to use various software in sketching experimental set-ups	The set-ups of experiments are correctly sketched using Chemistry software	Chemistry-based computer software	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(d) Prepare various compounds of metals (*oxides, hydroxides, carbonates, hydrogen carbonates, nitrates, chlorides, and sulphates*)	**Group discussion:** Organise students in manageable groups to examine different compounds of metals **Experimentation:** Assign students to prepare various compounds of metals using available chemicals in the laboratory	Various compounds of metals are correctly prepared	Periodic table, lead metal, iron strips, magnesium nitrate, zinc sulphate, lead nitrate, copper sulphate, silver nitrate, magnesium ribbon, aluminium foil, water trough, laboratory glassware, flasks, gas jars, Kipps apparatus, combustion tube, heat sources, hydrochloric acid, sulphuric acid and the first 20 elements of the periodic table	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(e)Demonstrate oxidizing and displacement properties of non-metallic compounds (*oxygen, hydrogen, chlorine, hydrogen chloride, sulphur dioxide, nitrogen, ammonia and carbon dioxide*)	**Group discussion:** Organise students in manageable groups to describe properties of non-metal compounds and make presentations **Inquiry-based learning:** Guide students to investigate industrial mechanisms involving oxidizing and displacement properties of non-metals	Oxidizing and displacement properties of non-metal compounds are correctly demonstrated	Periodic table, oxygen gas, hydrogen gas, chlorine gas, hydrogen chloride gas, sulphur dioxide gas, nitrogen gas, ammonia gas, carbon dioxide gas, coloured flower, dyes, hydrogen sulphide, iron (II) chloride, potassium dichromate and potassium permanganate and videos, animations or simulations, wall charts and pictures illustrating some important oxidation reactions	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(f) Prepare sulphuric acid from sulphur dioxide	**Experimentation:** Guide students to prepare sulphuric acid by using sulphur dioxide	Sulphuric acid from sulphur dioxide is correctly prepared	Wall charts showing the laboratory / industrial preparation of sulphuric acid, sulphur dioxide, distilled water, delivery tubes and flasks with side arms	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
3.0 Demonstrate mastery of basic principles of extraction of metals	3.1 Demonstrate mastery of the principles of extraction of metals	(a) Describe the extraction of iron from its ore (*ores, stages, and methods of extraction*)	**Field trips:** Organise students field trips to nearby mining sites/ factories to analyse the process for extraction of iron from its ores and write the report **Group discussion:** Organise students in manageable groups to describe stages and methods involved in extraction of metals and make presentation	The methods for iron extraction from its ore are clearly described	Wall charts showing the metals ores and their methods for extraction, and real ores for metals present in Tanzania	10

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
4.0 Conduct a project in Chemistry	4.1 Conduct a project in Chemistry	(a) Design and carry-out a simple research project in Chemistry	**Group discussion:** Guide students in manageable groups to analyse social and scientific challenges such as water pollutions, water purifications, rusting, fire outbreak, pesticides, acid and chemical waste management **Project works:** Guide students to apply Chemistry principles to investigate on domestic strategies for water purifications, metals purification, metal extraction. and develop local and scientific mechanisms for addressing the identified scientific challenges	A simple research project in Chemistry is designed and developed correctly	Library resources and videos, animations or simulations illustrating simple projects in chemistry	20

Form IV

Table 6: *Detailed Contents for Form IV*

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
1.0 Demonstrate mastery of basic concepts, theories and principles in Chemistry	1.1. Demonstrate mastery of concepts, theories and principles in Chemistry	(a) Explore the basic tenets of qualitative analysis (*preliminary analysis, tests in solution and confirmatory test*)	**Group discussion:** Guide students in manageable groups to explain the concept of qualitative analysis and make presentations **Laboratory activity:** Guide students to carry-out qualitative analysis and confirmatory tests for various salts	The basic tenets of qualitative analysis are clearly decribed	Qualitative analysis reagents, apparatus for qualitative analysis, qualitative analysis sheets, wall charts and samples of salts	36

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Explore the basic tenets of Organic Chemistry (organic compounds; aliphatic hydrocarbons and alcohols)	**Brainstorming:** Guide students to brainstorm on the concept of Organic Chemistry **Group discussion:** Guide students in manageable groups to describe categories of hydrocarbons and alcohols and make presentations	The basic tenets of Organic Chemistry are clearly explained	Molecular models and organic substances present in environment	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
2.0 Demonstrate mastery of basic terminologies in Chemistry	2.1 Use the International Union of Pure and Applied Chemistry nomenclature to name chemical species	(a) Use Chemistry software to draw organic structures of hydrocarbons and alcohols with 1 carbon to 10 carbon atoms	**Experimentation:** Guide students to use the Chemistry software to draw organic structures of organic compounds such as hydrocarbons and alcohols	Organic structures of hydrocarbons and alcohols with 1 carbon to 10 carbon atoms are correctly drawn using the Chemistry software	Chemistry-based computer software, organic model and wall chart	36

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Name aliphatic hydrocarbons and alcohols with 1 carbon to 10 carbon atoms using the IUPAC system and Chemistry software	**Group discussion:** Guide students in manageable groups to identify and name the first ten compounds of aliphatic hydrocarbons using IUPAC system and chemistry software, and make presentation **Laboratory observations:** Guide students to make laboratory observations of labels on containers of hydrocarbons and alcohols	Aliphatic hydrocarbons and alcohols with 1 carbon to 10 carbon atoms are correctly named using IUPAC system	Wall charts showing structures of hydrocarbons, molecular model kits, bottles/ containers containing labelled hydrocarbons and alcohols	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
	2.2 Use chemical symbols, formulae and equations to represent chemical reaction	(a) Describe the chemical reactions of aliphatic hydrocarbons and alcohols in relation to their structures	**Gallery walk:** Guide students to describe chemical reactions and make presentations **Role play:** Guide students to demonstrate on the structures of aliphatic hydrocarbons and write report **Group discussion:** Guide students in manageable groups to describe reactions of alcohols and make presentations	Chemical reactions of aliphatic hydrocarbons and alcohols are described clearly in relation to their structures	Wall charts, pictures and videos showing chemical reactions of aliphatic hydrocarbons and alcohols	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
3.0 Conduct experiments in Chemistry	3.1 Conduct experiments in Chemistry	(a) Investigate the composition of chemical species in substances using systematic qualitative analysis	**Inquiry-based learning:** Assign students to investigate on the composition of substances using appropriate qualitative analysis procedures **Group discussion:** Guide students in manageable groups to describe the behaviours/ properties for cations and anions in a chemical reactions	The composition of chemical species in substances using systematic qualitative analysis are correctly investigated	Qualitative analysis reagents, apparatus for qualitative analysis, qualitative analysis sheets, wall charts and samples of salts	36

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Demonstrate the local and industrial preparations of aliphatic hydrocarbons and alcohols	**Hands-on-minds on:** Guide students to demonstrate local and industrial preparations of aliphatic hydrocarbons and alcohols and write the reports **Experimentation:** Assign students to perform experiment on reactions involving preparations of aliphatic hydrocarbons and alcohols	The local and industrial preparation of aliphatic hydrocarbons and alcohols are clearly demonstrated	Wall charts showing distillers, and relevant chemicals and solvents for preparation of alcohols and hydrocarbons with 1 carbon to 10 carbon atoms	

Main Competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
4.0 Conduct a project in Chemistry	4.1 Conduct a project in Chemistry	(a) Complete and submit a report for the project started in Form Three	**Project works**: Guide students to apply Chemistry principles to investigate scientific processes such as water purification, environmental user- friendly metal extraction and purification, food processing and beverage production	Scientific report of the project is clearly written and quality project product(s) are obtained	Samples, project guidelines, sample of project reports and chemistry based software	24

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