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MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

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Commissioner for Education

CHEMISTRY SYLLABUS FOR ADVANCED SECONDARY EDUCATION FORM V-VI

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Abbreviations and Acronyms

ICT	Information and Communication Technology
IUPAC	International Union of Pure and Applied Chemistry
TIE	Tanzania Institute of Education

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Dr Aneth A. Komba

Director General

Tanzania Institute of Education

1.0 Introduction

Chemistry for Advanced Secondary Education is a compulsory subject for students who choose to join the Natural Science stream taking Chemistry among the subjects in their combinations. The purpose of learning Chemistry at this level is to deepen the students' understanding on the composition, structure, and properties of matter and the changes which different matter undergo under different conditions. Studying this subject equips students with skills of synthesising chemistry products and materials that are utilised in everyday life. Therefore, this subject is useful for preparing students for the real world as it plays key roles in everyone life and touches almost every aspect in our existence by meeting crucial needs such as food, health, shelter, water, manufactured products and energy. Furthermore, the subject serves as a bridge to enable students 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 Advanced Secondary Education Form V-VI in the United Republic of Tanzania. The syllabus interprets the competences indicated in the 2023 Advanced 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 literacy 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 in Tanzania 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 Advanced Secondary Education

The objectives of Advanced Secondary Education, are to:

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

(b) Safeguard customs and traditions, national unity, national virtues, 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 the use of language in academic communication;

(e) Strengthen accountability for cross-cutting issues, including health, security, gender equality and sustainable environmental 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 a college education.

4.0 General Competences for Advanced Secondary Education

The general competences for Advanced Secondary Education are to:

(a) Apply the knowledge and skills acquired in Ordinary Secondary Education to strengthen and broaden academic understanding;

(b) Demonstrate an appreciation of citizenship, national virtues, human rights and civil rights:

(c) Demonstrate confidence in learning various fields, including science and technology, theoretical knowledge and vocational education;

(d) Use language skills in academic communication;

(e) Apply knowledge of cross-cutting issues to master the surrounding environment;

(f) Use knowledge and skills to enable him/her to employ oneself, be employed as well as manage life and his/her environment; and

(g) Demonstrate readiness to proceed to the next level of education.

5.0 Main and Specific Competences

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

Table 1: *Main and Specific Competences for Form V-VI*

Main competences	Specific competences
1.0 Demonstrate mastery of the concepts, theories and principles in Chemistry	1.1 Demonstrate an advanced understanding of the concepts, theories and principles in Chemistry 1.2 Demonstrate an understanding of changes in the physical and chemical properties of elements according to their position in the periodic table 1.3 Demonstrate an understanding of chemical concepts and principles and their applications in different contexts 1.4 Demonstrate an understanding of advanced concepts and principles in organic chemistry
2.0 Conduct experiments in Chemistry	2.1 Conduct synthesis of selected organic compounds
3.0 Conduct a project in Chemistry	3.1 Conduct a project in Chemistry

6.0 Roles of Teachers, Students, and Parents in the Teaching and Learning Process

A good relationship between teachers, students and parents/guardians is fundamental in ensuring successful learning. This section outlines the roles of each participant in facilitating effective teaching and learning Chemistry.

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 ability to:

(i) develop the competences needed in the 21st Century; and

(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 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 in online libraries.

6.3 The parent

The parent/guardian is expected to:

(a) Monitor the child's academic progress in school;

(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 work.

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 requires 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 information from various sources 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 VI Examination shall be 70% of the student's final achievement, as presented in Table 2.

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

Assessment Measures	**Form V**	**Form VI**
First Term Examination	5%	5%
Second Term Examination	5%	-
Project	-	10%
Mock Examination	-	5%
National Examination	-	70%
Total	**100%**	

10.0 Number of Periods

The Chemistry Syllabus for Advanced 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. Ten periods of 40 minutes each, have been allocated for this subject per week.

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 number of periods as presented in Tables 3-4.

Form V

Table 3: *Detailed Contents for Form V*

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
1.0 Demonstrate mastery of the concepts, theories and principles in Chemistry	1.1 Demonstrate an advanced understanding of the concepts, theories and principles in Chemistry	(a) Describe the concept of the atom (*Dalton's atomic theory, Bohr's atomic theory and quantum theory*)	**ICT based learning:** Organise students to watch simulations, animations, videos or diagrams that illustrate the structure of an atom and write appropriate report	The concept of the atom is clearly described	Pictures, diagrams, simulations, animations or videos illustrating the structure of an atom	90
		(b) Use different atomic theories to determine the electronic configuration of elements with different properties	**Interactive simulation:** Guide students through interactive demonstrations, and explanations to explore the electronic configuration of elements with different properties **Peers coaching:** Guide students to use different atomic theories to describe electronic configuration of elements with different properties and share to other students	Electronic configuration of elements with different properties are clearly determined	Pictures, wall charts and simulation illustrating the electronic configuration of elements	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(c) Explain the concept of chemical bonding and the interactions of atoms to form molecules	**Hands-on experience activities**: Guide students to observe different materials with different types of chemical bonding and build models of different molecules using locally available materials **Group discussion**: Guide students to discuss the interactions of atoms to form molecules and interpret the physical properties of different substances basing on their structures and bonding	The concept of chemical bonding and interactions of atom to form molecules is clearly explained	Molecular models, pictures, local materials, and video showing interactions of atoms	
		(d) Describe the concept of gases in terms of the gas laws and the kinetic theory of gases	**ICT based learning**: Guide students to visualise simulations and videos to describe the concept of gas laws and kinetic theory of gases and write a report **Experimentation**: Guide students to perform experiments on the kinetic theory of gases	The concept of gases in terms of gas laws and the kinetic theory of gases is clearly described	Diagrams, pictures, wall charts, simulations and videos illustrating gas laws and kinetic theory of gases balloons, pollen grains, water, light source, microscope, thermometer, bicycle pump, heat source and bicycle tyres	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(e) Appreciate the applications of gas laws in daily life such as in fire extinguishers, aerosols, inflating tyres, bakery, liquefaction of gases and helium balloons	**Project:** Task students to investigate the applications of gas laws and kinetic theory of gases in their environment	Applications of gas laws in daily life are realised	Bicycle pump, bicycle tyres, fire extinguisher, spray, balloons and $NaHCO_3$	
	1.2 Demonstrate an understanding of changes in the physical and chemical properties of elements according to their positions in the periodic table	(a) Explore the periodic trends of elements in the modern periodic table (*Electronegativity, ionisation energy, electron affinity, atomic radius, melting point, and metallic character*)	**Graphics method**: Guide students to use graphic organisers to represent the periodic trends of elements in the modern periodic table	Periodic trends of elements in the modern periodic table are well described	Pictures, wall charts of modern periodic table, and graphics programme demonstrating periodic trends of elements	36

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
			Inquiry-based learning: Guide students through explorations and asking questions to interpret the periodic trends of elements in the modern periodic table			
		(b) Analyse the periodic trends of elements in relation to their physical and chemical properties	**Experimentation**: Guide students to carry out experiments to analyse the periodic trends of elements in relation to their physical and chemical properties	Periodic trends of elements in relation to their physical and chemical properties are analysed correctly	Pictures, wall chart of modern periodic table, H_2O, HCl, metal carbonates, HNO_3, hydrides, chlorides, hydroxides of metals, oxides of Period 3, Bunsen burner, magnesium metal, sodium metal, calcium metal and electric current	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
	1.3 Demonstrate an understanding of chemical concepts and principles and their applications in different contexts	(a) Describe the concept of colligative properties in understanding responses of the system towards changes in the environment (*boiling point elevation, freezing point depression, osmotic pressure, relative lowering of vapour pressure and Raoult's law*)	**Inquiry-based learning:** Guide students through exploration and asking questions to describe different colligative properties in their environment	Colligative properties are correctly described	Thermometer, beaker, common salt, table sugar, weighing bottle, Beckman's apparatus, Landsberger apparatus osmometer, plastic bottle, analytical balance, freezing point apparatus, ethyl glycol, coolants and video showing colligative properties	124

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Examine the applications of colligative properties in the purification of water, dialysis, preservation of food and in antifreeze and coolants	**Project:** Task students to investigate the applications of colligative properties in industrial processes, automobiles and medicine	The applications of the concept of colligative properties in the purification of water, dialysis, preservation of food and in antifreeze and coolants are clearly described	Pictures, simulation, video, illustrating applications of colligative properties and coolants	
		(c) Describe the concept of two component liquid systems (*immiscible liquid, completely miscible liquid and the distribution law*)	**Interactive simulation**: Encourage students through interactive demonstration, explanations and hand-on activities to describe the properties of two component liquid systems **Experimentation**: Guide students to carry out experiments on two component liquid systems	The concept of two component liquid systems is clearly described	Separating funnel, beaker, immiscible and partially immiscible liquids, distillation apparatus, ideal and	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
					non-ideal solutions, side armed flask, fractionating column, thermometer, boiling flasks, condensers, pipettes, iodine, petroleum ether, burettes, flowers, leaves and propanone	
		(d) Examine the applications of two component liquid systems in pharmaceutical industries and in the extraction of plant components, separation and purification of substances	**Problem-based learning**: Create environment for students to explore the applications of two component liquid systems in solving real life scenarios in their environment	Applications of two component liquid systems are well examined	Pictures, video simulation, illustrating applications of two component liquid systems	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(e) Describe the concept of energetics (*Heat/enthalpy of reactions and Hess's law*)	**Group discussion:** Guide students to discuss the concept of energetics **Experimentation:** Guide students to carry out experiments on energetics	The concepts of heat/ enthalpy of reactions and Hess's law are clearly described	Salts, acid, base, thermometer, analytical balance, magnesium ribbon, sodium thiosulphate, calorimeters, chemical indicators and simulation, illustrating energetics	
		(f) Examine the applications of energetics in daily life in combustion of fuel, cooking and human body metabolism	**Problem-solving method:** Provide students with scenario or case study and task them to investigate the applications of energetics in their environment	Applications of energetics in daily life are clearly examined and demonstrated	Pictures, wall charts, video showing applications of energetics	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
	1.4 Demonstrate an understanding of advanced concepts and principles in organic chemistry	(a) Describe the concepts of aromatic hydrocarbons, carbonyl compounds, carboxylic acids and their derivatives, haloalkanes, amines and polymers	**ICT-based learning:** Guide students to use visual aids to describe the concepts of aromatic hydrocarbons, carbonyl compounds, carboxylic acids and their derivatives, haloalkanes, amines and polymers **Library search:** Task students to read articles and present information on the health hazards associated with polycyclic aromatic hydrocarbons (PAHs), carbonyl compounds, carboxylic acids, haloalkanes, amines and polymers	The concepts of aromatic hydrocarbons, carbonyl compounds, carboxylic acids and their derivatives, haloalkanes, amines and polymers are clearly described	Molecular models, visual aids and pictures, illustrating organic compounds, products made from aromatic hydrocarbons such as dyes, pesticides and medicine	82
		(b) Apply IUPAC rules in naming of aromatic hydrocarbons, carbonyl compounds,	**Inquiry-based learning:** Guide students to explore the IUPAC rules for naming aromatic hydrocarbons, carbonyl compounds,	IUPAC rules of naming aromatic hydrocarbons, carbonyl compounds,	Chemistry-based computer software and containers with labelled	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		carboxylic acids and their derivatives, haloalkanes, amines and polymers	carboxylic acids and their derivatives, haloalkanes, amines and polymers	carboxylic acids and their derivatives, haloalkanes, amines and polymers are well applied	organic compounds	
		(c) Examine reactions of aromatic hydrocarbons, carbonyl compounds, and carboxylic acids and their derivatives for preparation of useful organic products like soaps, perfumes and pesticides	**ICT-based learning:** Guide students to use visual aids to explore the reactions of aromatic hydrocarbons, carbonyl compounds, and carboxylic acids and their derivatives **Practical works:** Guide students to isolate essential oils from plant materials and spices, and carry out experiments on the preparations of soaps, perfumes and pesticides	Reactions of aromatic hydrocarbons, carbonyl compounds and, carboxylic acids and their derivatives are properly examined and demonstrated	Fragrances, alcohols, distillers, oil and fat, KOH/NaOH, glycerine, orange peels, lemon grass, ginger roots, rose flowers and other scented plant materials, laboratory note book and visual aids to describing selected organic compounds	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(d) Examine reactions of haloalkanes, amines and polymers for preparation of useful organic products like plastics, dyes, detergents and rubber	**ICT-based learning:** Guide students to use visual aids to explore the reactions of haloalkanes, amines and polymers **Inquiry-based learning**: Task students to search and present information related to structures and properties of polymeric materials used as adhesives, semiconductors packaging and insulators **Hands-on mind-on activities:** Guide students to carry out experiments on the preparation of plastics, dyes, detergents and rubber	Reactions of haloalkanes, amines and polymers are properly examined and demonstrated	Starch, cellulose, vegetable oils, natural sources of dyes, plastic materials, food stuffs and visual aids showing reactions of haloalkanes, amines and polymers	

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 synthesis of selected organic compounds	(a) Synthesise aromatic hydrocarbons, carbonyl compounds and, carboxylic acids and their derivatives	**Experimentation**: Guide students to carry out laboratory experiments and tests on the synthesis of aromatic hydrocarbons, carbonyl compounds, and carboxylic acids and their derivatives	Aromatic hydrocarbons, carbonyl compounds and, carboxylic acids and their derivatives are synthesised and tested	Ethylene, caustic soda, sulphonic acid, perfume, water, selected apparatus/ equipment for organic reactions, and laboratory notebook	28

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
3.0 Conduct a project in Chemistry	3.1 Conduct a project in Chemistry	(a) Design and carry out a project in Chemistry	**Project:** Guide students to design a project from any Chemistry themes **Field trip:** Task students to investigate the selected Chemistry theme and carry out the project	The project is well designed and carried out	Factories for production of different products, project guidelines, sample of project reports, laboratory facilities, and materials	30

Form VI

Table 4: *Detailed Contents for Form VI*

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
1.0 Demonstrate mastery of the concepts, theories and principles in Chemistry	1.1. Demonstrate an advanced understanding of the concepts, theories and principles of Chemistry	(a) Describe the concept of chemical equilibria in predicting the direction of reactions for formation of desired products (*dynamic equilibrium, ionic equilibrium and acid-base equilibrium*)	**Group discussion:** Guide students to discuss the concept of chemical equilibria	The concept of chemical equilibria are clearly described	Ethanol, ethanoic acid, H_2, I_2, platinum source of heat, NH_3, H_2SO_4, water, wood ash, lemons, acid, bases, weak and strong acids weak and strong bases, pH meter, acetic acid/sodium acetate, litmus paper, universal indicator, NH_3, NH_4Cl, $NH_4(CH_3COO)$, $BaSO_4$, $CaCO_3$, AgCl, $AgNO_3$, Na_2SO_4, and $Ba(NO_3)_2$	96

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Perform experiments involving chemical equilibria and report the experimental results scientifically *(preparation of buffer solutions and, redox and acid-base titrations*)	**Experimentation:** Guide students to carry out experiments on dynamic equilibrium, ionic equilibrium and acid-base equilibrium	Experiments involving chemical equilibria and experimental results are scientifically performed		
		(c) Assess the applications of chemical equilibria in industries and daily life (*manufacture of H_2SO_4, fertilizers, photochromic lenses and, acids, bases and salts in food industries*)	**Problem-based learning:** Task students to investigate the applications of chemical equilibria in industries and daily life	Applications of chemical equilibria in industries and daily life are well assessed		

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
	1.2 Demonstrate an understanding of changes in the physical and chemical properties of elements according to their position in the periodic table	(a) Describe the physical and chemical properties of transition elements (*variable oxidation states, catalytic properties, magnetic properties, alloy formation*)	**Interactive simulation**: Employ visual aids to guide students to describe physical and chemical properties of transition elements	Physical and chemical properties of transition elements are clearly described	Wall charts of modern periodic table, wall charts showing variable oxidation states of first row transition elements (atomic numbers 21– 30), wall chart showing diagrams of split *d*-orbital, finely divided first row transition elements and their chlorides, carbonates, sulphates, hydroxides and nitrates, bar magnet, ICT facilities, NaOH, NH_4OH, H_2SO_4, NH_3, HNO_3, HCl, $KMnO_4$, $[Co(NH_3)_6]Cl_3$, $Cu_2[Fe(CN)_6]$, $[Pt(NH_3)_6]Cl_4$, $[Ni(H_2O)_6]Cl_2$, $[Cr(NH_3)_5(NO_2)]Cl_2$ $[Ag(NH_3)_2]Cl$ $K[Pt(NH_3)Cl_3]$	120

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Describe the concept of complex compounds (*type of complexes and factors affecting complex formation*)	**ICT based learning:** Through interactive demonstrations, explanations and hands-on activities guide students to visualise simulations and describe the concept of complex formation	The concept of complex compounds is clearly described		
		(c) Explore reactions of complex compounds	**Experimentation:** Guide students to carry out experiments on the reactions of complex compounds and prepare scientific reports	Reactions of complex compounds are clearly explored and performed		
		(d) Analyse the uses of transition elements and complex compounds in industries (*as conductors, catalysts, alloys and ornaments*)	**Project:** Task students to investigate the applications of transition elements and complex compounds as conductors, catalysts, alloys and ornaments	Uses of transition elements and complex compounds in industries are analysed		

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
	1.3 Demonstrate an understanding of chemical concepts and principles and their application in different contexts	(a) Describe the concept of chemical kinetics (*rate laws, activation energy, catalysis*)	**Group discussion:** Guide students to describe the concept of chemical kinetics **Experimentation:** Guide students to design and perform experiments to investigate factors affecting the rate of chemical reactions	The concepts of chemical kinetics are clearly described	MnO_2, $KMnO_4$, heat source, marble chips, powdered $CaCO_3$, HCl, NH_3, HI, water, $H_2C_2O_4$, H_2SO_4, H_2O_2, Na_2CO_3, HNO_3, $Na_2S_2O_3$ thermometer with 100 °C, 1 °C precision, common laboratory glassware and baking powder	114

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Investigate the applications of chemical kinetics in industries and real-life situation (*catalyst in production*, *medical aspects*, *baking industries, food storage*)	**Problem-based learning:** Task students to investigate the applications of chemical kinetics in industries and real-life situations	Applications of chemical kinetics in industries and real-life situations are properly investigated		
		(c) Describe the concept of electrochemistry (*electrochemical cells and electrode potentials*)	**Interactive simulation:** Employ visual aids to guide students to explore the concept of electrochemistry and develop different types of cells, example the H_2O_2 fuel cell and the nickel-metal hydride	The concept of electrochemistry are clearly described	Rusted iron, visual aids illustrating electrochemistry, Fe_2O_3, KIO_3, $KMnO_4$, $K_4Fe(CN)_6$, and $Na_2Cr_2O_7$,	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
			Inquiry-based learning: Guide students to develop awareness and responsible practices when handling chemicals used in electrochemical industries and laboratories		$H_2C_2O_4$, KI, $Ni(OH)_2$, hydrides of Pd, V, Ti, Ni, Cr and Co, batteries, metal electrodes, inert electrode, $CuSO_4$; HCl, galvanised ion H_2SO_4, tin, zinc $ZnCl_2$, conductance bridge and water	
		(d) Investigate the applications of electrochemistry in industries and real life situation (*corrosion inhibition, purification of metals and batteries productions*)	**Problem-based learning:** Task students to investigate the applications of electrochemistry in industries and real life situations	Applications of electrochemistry in industries and real-life situations are properly investigated		

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
2.0 Conduct a project in Chemistry	2.1 Conduct a project in Chemistry	(a) Complete and submit for assessment a scientific report of the project started in Form Five	**Practical:** Guide students to perform experiments of the selected Chemistry themes started in Form Five **Project:** Guide students to analyse the experimental data by using ICT facilities and submit the synthesised product(s) and scientific report for assessment	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	60

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