SEMESTER LEARNING PLAN

CHEMISTRY OF SCIENCE AND TECHNOLOGY (KIM 1104 3(2-1))

By:
Chemistry PPKU Team

DEPARTMENT OF CHEMISTRY
FACULTY OF MATHEMATICS AND NATURAL SCIENCE
IPB UNIVERSITY
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SEMESTER LEARNING PLAN

Course/Code	:	Chemistry of Science and Technology/KIM1104
Semester/sks	:	Odd and Even/3(2-1)
Course Description	:	This course encourages students to actualize Chemistry as the Central of Science for the foundation of Science and Technology (IPTEK) in the fields of agriculture, marine science, and tropical bioscience. The theoretical foundation will begin by providing insights into the contribution of chemistry to global technology, its relationship with other sciences, the efficiency of atoms for product synthesis, dynamics and rate of change of products, and the utilization of products for technological advancements benefiting the well-being of living organisms.
Prerequisite Course	:	---
Course Learning Outcomes	:	1. Able to understand Chemistry as the Central of Science for Science and Technology (IPTEK) in the fields of agriculture, marine science, and tropical bioscience. 2. Able to apply the basic concepts of Chemistry to design the structure, dynamics, and rate of change in life systems related to energy exploration for the future. 3. Able to communicate and express opinions and ideas logically to solve problems and appreciate the opinions of others. 4. Able to collaborate and cooperate through teamwork while considering aspects of safety, health, and the environment.
Division/Field of Study	:	DPKU/Chemistry

Lecturer	:	DPKU Chemistry Teaching Team

Semester Learning Plan:

A. Lecture

Week	Expected Final Competence – Sub-CPMK	Learning Materials	Learning Method	Estimated Time	Student Learning Experience	Indicators	Assessment Criteria	Scoring Weight
1	2	3	4	5	6	7	8	9
1	**Topic of Discussion: Chemical Inventions that Changed the World** ---------- Able to: a. Explain the contribution of Chemistry to the world as the Central of Science in various aspects of life, such as inventions and technological advancements, and their applications in various fields, especially agriculture, marine, and tropical biosciences, b. Propose new ideas for sustainable development through the application of scientific methods.	a. Course Contract b. Group Formation c. Video on Chemical Inventions that Changed the World d. Chemical Inventions that Changed the World e. Scientific method f. Classification of Matter	Synchronous (offline) lecture, includes: a. Video Presentation (at the beginning of the session) b. Lecture c. Interactive Class Discussion d. Review of Discussion Results	2 x 50 minutes	a. Obtaining knowledge and explanations about the contribution of Chemistry to various aspects of life, as well as new ideas for sustainable development through visual learning. b. Engaging in interaction between: (i) Students and teaching materials (ii) Students and lecturer (iii) students and other students c. Achieving mutual understanding, agreement, and consensus on the understanding,	80% of the students answered with complete and accurate understanding of the scope and stages of the scientific method, as well as the classification of different types of matter. 80% of the students answered with complete and accurate understanding of the contributions of chemistry to various aspects of life in the fields of agriculture, marine, and tropical biosciences. 70% of the students were able to propose new ideas for	Completeness and accuracy in understanding, scope, and stages of the scientific method and classification of different types of matter. Completeness and accuracy in explaining the contributions of chemistry to various aspects of life in the fields of agriculture, marine, and tropical biosciences. Creativity, novelty, and viability of new ideas for sustainable development.	5%

					opinions, agreements, and decisions regarding a problem.	sustainable development.	Responsibility, discipline, accuracy, and completeness in formulating questions and statements during interactive discussions.	
2	**Topic of Discussion:** ***Green Chemistry for Human Well-being: Chemical Architecture*** ---------- Able to explain: a. Design, modeling, and determining parameters of material stability b. The influence of chemical architecture on biological function, agrochemistry, and technology.	**Week-2** a. Video on Molecular Architecture Throughout Time b. Molecular Architecture Throughout Time Theoretical Foundation: (i) Development of Atomic Theory (ii) Periodic Table and Periodic Properties of Elements (iii) Intramolecular Bonding (iv) Electronegativity (v) Molecular Polarity and Simple Molecular Geometry	**Week-2** Synchronous (offline) lecture, includes: a. Video Presentation (at the beginning of the session) b. Lecture c. Interactive Classroom Discussion d. Review of Discussion Results	2 x 50 minutes	**Week-2** a. Obtaining knowledge and explanations about the design, modeling, and determining factors of material stability, as well as the influence of chemical architecture on biological function, agrochemistry, and technology through visual learning. b. Engaging in interaction between: (i) students and teaching materials (ii) students and lecturers (iii) students and other students c. Obtaining consensus/agreement on	**Week-2** 75% of the students answered completely and correctly the items a-e based on the assessment criteria.	**Week-2** The completeness and accuracy of explanations regarding: a. Development of atomic theory (Dalton's atomic model to the modern atomic model) b. Periodic system and periodic properties of elements c. Types and importance of intramolecular bonding in chemical architecture d. Electronegativity and polarity: Definition and its influence on molecular architecture e. Simple molecular geometry	5%

					understanding, opinions, agreements, and collective decisions regarding a particular issue.	75% of the students answered accurately and comprehensively about the influence and provided several examples of chemical architecture in biological function, agrochemistry, and technology.	Completeness and accuracy of explanations on the influence and several examples of chemical architecture in biological function, agrochemistry, and technology. Active participation, cooperation, responsibility, discipline, accuracy, and completeness in formulating questions and statements during interactive discussions.	
3	**Topic of Discussion: Dynamics of Matter States** ---------- Able to: a. Explain intermolecular interactions and their roles in the behavior of matter states: gas, liquid, solid, and plasma b. Provide examples of applications in the fields of agriculture, tropical biosciences, and marine sciences	**Week-3** a. Video on Dynamics of The State of Matters b. Dynamics of State of Matters and Its Applications Theoretical Foundation: (i) State of matter: Gas (Ideal & Real), Liquid, Solid, Plasma (ii) Intermolecular Interactions (iii) Phase Diagram of a Single	**Week-3** Synchronous (offline) lecture, includes: a. Video Presentation (at the beginning of the session) b. Lecture c. Interactive Classroom Discussion d. Review of Discussion Results or	2 x 50 minutes)	**Week-3** a. Obtaining knowledge and explanations about intermolecular interactions and their roles in the behavior of gas, liquid, and solid states of matter, as well as examples of applications in the fields of agriculture, tropical biosciences, and marine sciences through visual learning.	**Week-3** 75% of the students answer items a-d correctly in the assessment criteria.	**Week-3** The completeness and accuracy regarding: a. Characteristics of states of matter b. Characteristics and differences between ideal and real gasses c. Types and importance of intermolecular interactions d. Explanation of the interpretation of simple phase diagrams (Phase Diagram 1	5%

		Component (1 component)	Asynchronous Online Learning using LMS, including the use of features: a. Discussion Forum b. Quiz c. Page/Link for Reference Sources (text, audio-visual)		b. Engaging in interaction between: (i) students and teaching materials (ii) students and lecturers (iii) students and other students c. Achieving agreement/consensus on understanding, opinions, and agreements, as well as making collective decisions regarding a problem.	80% of the students provide examples of applications of intermolecular interactions in the fields of agriculture, biosciences, and marine sciences.	component = Phase Diagram H_2O and CO_2) Completeness and diversity of examples of applications of intermolecular interactions in the fields of agriculture, biosciences, and marine sciences. Active participation, cooperation, responsibility, discipline, accuracy, and completion in formulating questions and statements during interactive discussions.	
4	**Topic of Discussion: Green Chemistry for Human Well-being: Atom Economy** Able to use the stoichiometry concept as the basis for calculations and atom economy.	**Week-4** a. Video about Atomic Economy b. Atomic Economy Theoretical Foundation: (i) Chemical Equations (ii) Quantity of Substance (moles) (iii) Empirical and Molecular Formulas	**Week-4** Synchronous (offline) lecture, includes: a. Video Presentation (at the beginning of the session) b. Lecture c. Interactive Class Discussion	2 x 50 minutes	**Week-4** Gaining insights and using stoichiometry concepts as the basis for calculations and atom economy through visual learning. a. Engaging in interaction between: (i) students and teaching materials (ii) students and lecturers	**Week-4** 75% of the students answer items a-g correctly in the assessment criteria.	**Week-4** The completeness and accuracy regarding: a. Writing simple reaction equations b. Calculations utilizing the concept of stoichiometry c. Quantities in moles (mole concept) calculations d. Differences and determination of	5%

		(iv) Limiting Reactant (v) Percent Yield	d. Review of Discussion Results		(iii) students and other students b. Achieving understanding, agreement, and consensus, as well as making collective decisions regarding a problem.		empirical and molecular formulas e. Understanding and determination of the limiting reactant f. Explanation of the concept of percentage yield and calculation method g. Explanation of the application of atom economy in everyday life. Active participation, collaboration, responsibility, discipline, accuracy, and completeness in asking questions and making statements in interactive discussions.	
5	Able to apply the concept of stoichiometry of solutions in the fields of food, health, and environment	**Week- 5** a. Video on Mixtures and Their Technological Aspects b. Mixtures and Their	**Week- 5** Synchronous (offline) lecture, includes: a. Video Presentation (Beginning of the session) b. Lecture	2 x 50 minutes	**Week- 5** a. Obtaining insights and explanations about the application of stoichiometry in solution in the fields of industry, collaboration, and	**Week- 5** 75% of the students answer items a-f correctly in the assessment criteria.	**Week- 5** The completeness and accuracy regarding: a. Explanation of the definition, properties, and functions of the components that	5%

		Technological Aspects Theoretical Foundation: (i) Solution (ii) Concentration Colligative Properties	c. Interactive Class Discussion d. Review of Discussion Results		the environment through visual learning. b. Engaging in interaction between: (i) students and teaching materials (ii) students and lecturers (iii) students and other students c. Achieving alignment/understanding of definitions, opinions, agreements, and joint decisions regarding a problem.		make up a solution. b. Understanding and definition of various concentrations commonly used in everyday life. c. Calculation methods for various concentrations of solutions (Molarity, Normality, mass percent, volume percent, mole fraction). d. Understanding, properties, and functions of colligative properties. e. Calculation methods for colligative properties (boiling point elevation, freezing point depression, vapor pressure lowering, and osmotic pressure). f. Explanation of the application of stoichiometry of solutions in the fields of health,	

							industry, and environment. Activeness, collaboration, responsibility, discipline, accuracy, and completeness in making questions and statements during interactive discussions.	
6	**Topic of Discussion:** **Energy Toward Stability** Able to explain energy and its involvement in the changes of matter, including equilibrium phenomena.	**Week-6** a. Video about Energy Towards Stability b. Energy Towards Stability Theoretical Foundation: (i) The First Law of Thermodynamics (Thermochemistry) (ii) The Second Law of Thermodynamics	**Week-6** Synchronous (offline) lecture, includes: a. Video Presentation (at the beginning of the session) b. Lecture c. Interactive Classroom Discussion d. Review of Discussion Results	2 x 50 minutes	**Week-6** a. Obtaining knowledge and explanations about energy and its involvement in changes through visual learning b. Engaging in interaction between: (i) students and teaching materials (ii) students and lecturers (iii) students and other students c. Achieving consensus and mutual understanding of definitions, opinions, agreements, and	**Week-6** 75% of the students answer items a-b correctly in the assessment criteria.	**Week-6** The completeness and accuracy regarding: a. The difference between the First Law of Thermodynamics (Thermochemistry) and the Second Law of Thermodynamics b. Explanation of the applications of Thermochemistry in the fields of science and technology Active participation, collaboration, responsibility, discipline, accuracy, and completeness in formulating questions	5%

					collective decisions regarding a problem.		and statements during interactive discussions.	
7	**Topic of Discussion:** ***Green Chemistry for Human Well-being.*** Able to: 1. Apply the concept of Green Chemistry in everyday life, particularly in the fields of agriculture, health, energy, and the environment. 2. Analyze simple chemical cases by applying the principles of Green Chemistry.	**Week-7** Video on the applications of Green Chemistry Notes: Online learning materials (video assignment topic) is related to the topics discussed in the teaching materials.	**Week-7** Online learning, includes: a. Presentation/Video Presentation b. Interactive Discussion Forum	2 x 50 minutes	**Week-7** a. Obtaining insights and explanations about the concept of green chemistry and the application of green chemistry through online learning. b. Engaging in interaction between: (i) Students and teaching materials (ii) students and lecturers (iii) students and other students c. Achieving alignment/understanding of definitions, opinions, and agreements, as well as reaching collective decisions on a particular issue.	**Week-7** **Group Summary Task:** 80% of students completed the assignment thoroughly and accurately regarding the application of green chemistry materials.	**Week-7** **Group Video Task:** **a.** Accuracy of identity (name, date, title of the theme), Appropriateness of the systematic flow of video creation, Completeness of the content of the arranged video (completeness of provided information, representing the material). Activeness, cooperation, responsibility, discipline, accuracy, and completeness in asking questions and making statements in interactive discussions. Notes: Evaluation of Group Video Assignments using a Rubric.	**2,5%**

Mid-Term Exam (UTS)								**30%**
8	**Topic of Discussion:** **Energy Towards Stability** Able to explain energy and its involvement in changes of matter, including the phenomenon of equilibrium.	**Week-8** a. Video about Chemical Equilibrium Chemical Equilibrium Theoretical Foundation: (i) Chemical Equilibrium and Factors Affecting The Equilibrium	**Week-8** Synchronous (offline) lecture, includes: a. Video Presentation (at the beginning of the session) b. Lecture c. Interactive Classroom Discussion d. Review and Discussion Results	2 x 50 minutes	**Week-8** a. Obtaining insights and explanations about energy and its involvement in the phenomenon of equilibrium through visual learning. b. Engaging in interaction between: (i) students and teaching materials (ii) students and lecturers (iii) students and other students c. Achieving alignment/consensus in understanding, opinions, and agreements, as well as making collective decisions on a particular issue.	**Week-8** 75% of the students answer items a-d correctly in the assessment criteria.	**Week-8** The completeness and accuracy regarding: a. Definition of Dynamic Equilibrium (Reversible Reaction) b. Definition and determination of Equilibrium Constant c. Explanation of factors that influence the shift of chemical equilibrium d. Explanation of the application of the concept of chemical equilibrium in the fields of agriculture, tropical bioscience, and marine science Activeness, cooperation, responsibility, discipline, accuracy, and completeness in asking questions and making statements in interactive discussions.	5%

9	**Topic of Discussion:** **Acid-Base of Life** Able to explain basic Concepts of Acid-Base, Acid-Base Equilibrium, pH Scale, and the Significance of Buffer Systems in Life including Applications and Implications in Maintaining Biological Systems	**Week-9** a. Video on Acid-Base in Life b. Acid-Base in Life Theoretical Foundation: (i) Acid-Base Theories and Classification of Acids and Bases (ii) Acidity Level (pH) (iii) Equilibrium of Weak Acids and Bases and Salts (iv) Buffer Solutions	**Week-9** Synchronous (offline) lecture, includes: a. Video Presentation b. Lecture c. Interactive Classroom Discussion d. Review of Discussion Results	2 x 50 minutes	**Week-9** a. Obtaining insights and explanations about the basic concepts of acids and bases, acid-base equilibrium, pH level, and the significance of buffer systems in life, including the application of complex compound synthesis and their implications in maintaining biological systems through visual learning. b. Engaging in interaction between: (i) students and teaching materials (ii) students and lecturers (iii) students and other students c. Obtaining alignment/consensus in understanding, opinions, and agreements, as well as making	**Week-**9 75% of the students answer items a-f correctly in the assessment criteria.	**Week-9** The completeness and accuracy regarding: a. Theory of Acids and Bases (Arrhenius, Bronsted-Lowry, Lewis) Acid/Base in H2O Definition and determination of pH Definition and calculation of salt hydrolysis Definition, types, calculation, and uses of buffer solutions Application of acid-base concepts in the synthesis of complex compounds and their implications in maintaining biological systems Activeness, cooperation, responsibility, discipline, accuracy, and completeness in asking questions and making statements during interactive discussions.	5%

					collective decisions regarding a problem.			
10	**Topic of Discussion: Rate of Change in Living Systems and its Engineering** Able to explain the concept of molecular interactions as a function of time (reaction rate) in a chemical reaction influenced by various conditions that provide information about the mechanism and transition of changes	**Week-10** a. Video about Rate of Change in Living System and its Applications b. Rate of Change in Living System and its Application Theoretical Foundation: (i) Law of Reaction Rate (ii) Relationship between Concentration and Time (iii) Determining Factors of Reaction Rate (iv) Catalysts	**Week-10** Synchronous (offline) lecture, includes: a. Video Presentation (at the beginning of the session) Lecture Interactive Classroom Discussion Review of Discussion Results	2 x 50 minutes	**Week-10** a. Obtaining knowledge and explanations on the concept of molecular interactions as a function of time (reaction rate) in a chemical reaction influenced by various conditions, providing information on mechanisms and transition of changes through visual learning b. Engaging in interaction between: i. students and teaching materials ii. students and lecturers iii. students and other students c. Achieving consistency/understanding of definitions,	**Week-10** 75% of the students answer items a-g correctly in the assessment criteria.	**Week-10** The completeness and accuracy regarding: a. Definition and Equations of Reaction Rate b. Determination of Reaction Order c. Determination and Graph of Reaction Rate (Zeroth, First, and Second Order) d. Definition of Half-Life and Its Applications in Science and Technology e. Factors Affecting Reaction Rate f. Definition of Catalysis and Biocatalysis Reactions g. Applications of Chemical Kinetics in Science and Technology Engagement, Cooperation, Responsibility, Discipline, Accuracy,	5%

					opinions, and agreements, as well as making collective decisions on a problem		and Completion in Generating Questions and Statements in Interactive Discussions	
11	**Topic of Discussion: Electrochemistry as Energy Technology for the Future** --- Able to explain the concept of oxidation-reduction as one of the main types of reactions in chemical and biological systems, and its application as energy storage and generation.	**Week-11** a. Video on Electrochemistry as Energy Technology for the Future b. Electrochemistry as Energy Technology for the Future Theoretical Foundation: (i) Redox Reactions (ii) Galvanic Cells and Cell Diagrams (iii) Cell Potential (iv) Electrolysis	**Week-11** Synchronous (offline) lecture, includes: a. Video Presentation (Opening Meeting) Lecture Interactive Classroom Discussion Review of Discussion Results	2 x 50 minutes	**Week-11** a. Obtaining insights and explanations about the concept of molecular interactions as a function of time (reaction rate) in a chemical reaction that is influenced by various conditions, which provide information about the mechanism and transitional changes, through visual learning. b. Engaging in interaction between: (i) students and teaching materials (ii) students and lecturers (iii) students and other students c. Obtaining agreement and understanding regarding the	**Week-11** 75% of the students answer items a-e correctly in the assessment criteria.	**Week-11** The completeness and accuracy regarding: a. Definition and balancing of simple redox reactions b. Writing cell diagrams and characteristics of voltaic cells with examples c. Calculation of electrochemical potentials d. Characteristics of electrolytic cells with examples e. Applications of redox reactions in chemical and biological systems (energy storage and production) Activeness, collaboration, responsibility, discipline, accuracy, and completion in formulating questions	5%

					definition, opinions, and consensus, as well as reaching collective decisions on a problem.		and statements in interactive discussions.	
12	**Topic of Discussion: Life-Building Molecules** --- Able to explain the basic functional groups in organic compounds and the role of functional groups in small molecules and macromolecules that contribute to specific properties in the configuration of life.	**Week-12** a. Video about Life-Building Molecules: Organic Chemistry b. Life-Building Molecules: Organic Chemistry Theoretical Foundation: Simple functional groups and their implications in everyday life: (i) Alkane (ii) Alkene (iii) Alkyne (iv) Organohalogen (v) Alcohol (vi) Amine (vii) Carbonyl functional group (viii) Ether (ix) Sulfur	**Week-12** Online asynchronous learning using a learning management system (LMS), including the utilization of features such as: a. Discussion forum b. Quiz c. Page/Link for reference sources (text, audio-visual)	2x1x50 minutes	**Week-12** a. Acquiring insights and explanations about the Life-Building Molecules: Organic Chemistry through visual learning b. Engaging in interaction between: (i) students and teaching materials (ii) students and lecturers (iii) students and other students c. Obtaining alignment/consensus in understanding, opinions, and agreements, as well as making collective decisions regarding a problem.	**Week-12** 75% of the students answered the criteria assessment topic completely and correctly.	**Week-12-13** The completeness and accuracy of explanations regarding the concept of functional groups involved in simple molecules and their implications on the properties and reactions of pharmaceutical and industrial materials, including in the agro-maritime field. Activeness, cooperation, responsibility, discipline, accuracy, and completeness in asking questions and making statements in interactive discussions.	5%
13	**Topic of Discussion: Life-Building Molecules**	**Week-13**	**Week-13**	2x1x50 minutes	**Week-13**	**Week-13**	**Week-13**	5%

	---------- Able to explain organic molecules and polymers that are irreplaceable in human life as/in pharmaceuticals, chemical industry, and agro-maritime field.	a. Video on Life-Building Molecules: Polymers b. Building Life-Building Molecules: Polymers Theoretical Foundation: Functional groups in macromolecules and their implications. (i) Carbohydrates (ii) Proteins (iii) Nucleic Acids (iv) Lipids (v) Natural Polymers (vi) Synthetic Polymers	Synchronous (offline) lecture, includes: a. Video Presentation (Opening Meeting) b. Lecture c. Interactive Classroom Discussion d. Review of Discussion Results		a. Obtaining insights and explanations about the Life-Building Molecules: Polymers through visual learning. b. Engaging in interaction between: (i) students and teaching materials (ii) students and lecturers (iii) students and other students c. Obtaining alignment/understanding of definitions, opinions, agreements, and collective decisions regarding a problem.	75% of the students answer items a-b correctly and completely in the assessment criteria.	a. The completeness and accuracy of explanations regarding natural polymers and synthetic polymers and their implications on the properties and reactions of pharmaceutical and industrial materials, including in the field of agromaritime. b. The completeness and accuracy of explanations regarding: 1. Definition, types, and characteristics of natural and synthetic polymers 2. Monomers and polymerization reactions 3. Applications of polymers in pharmaceuticals, chemical industry, and agro-	

							maritime field Activeness, collaboration, responsibility, discipline, accuracy, and completeness in generating questions and statements during interactive discussions.	
14	**Topic of Discussion: Assignment: Create a video on a topic related to (any or all of) the subjects covered in the pre-midterm period (Chemical Equilibrium, Acid-Base of Life, Rate of Change in Living Systems and its Engineering, Electrochemistry as Future Energy Technology, Life-Building Molecules).** Able to explain the concepts and provide examples of the application and solving of cases related to the following chemical concepts (Chemical Equilibrium, Acid-Base of Life, Rate of Change in Living Systems and its Engineering,	**Week-14** Video about the applications of chemical concepts (Chemical Equilibrium, Acid-Base of Life, Rate of Change in Living Systems and its Engineering, Electrochemistry as Future Energy Technology, Life-Building Molecules). Notes: The online learning material (topic of video assignment) is selected from the Topics of Discussion within the teaching material.	**Week-14** Online Learning, including: a. Video Presentation b. Interactive Discussion Forum	2 x 50 minutes	**Week-7** a. Obtaining insights and explanations about the concepts of chemistry (Chemical Equilibrium, Acid-Base of Life, Rate of Change in Living Systems and its Engineering, Electrochemistry as Future Energy Technology, Life-Building Molecules) and their applications through online learning. b. Engaging in interaction between: (i) Students and teaching materials	**Week-7** **Group Summary Task:** 80% of the students completed the assignment accurately and comprehensively regarding the application of the subject matter (Chemical Equilibrium, Acid-Base of Life, Rate of Change in Living Systems and its Engineering, Electrokinesis as Future Energy Technology, Life-Building Molecules).	**Week-7** **Group Video Task:** **a.** The Accuracy of Identity (Name, Date, Title of the Theme), **b.** The Consistency of the Video's Systematic Flow, **c.** The Completeness of the Prepared Video Content (Providing Sufficient Information, Representing the Material) Active participation, cooperation, responsibility, discipline, accuracy, and completeness in formulating questions and statements during interactive discussions.	2,5%

	Electrochemistry as Future Energy Technology, Life-Building Molecules) through a video assignment.				(ii) students and lecturers (iii) students and other students c. Achieving consensus/understanding of the definition, opinions, and agreement, as well as reaching a collective decision regarding a problem.		Notes: Evaluation of Group Video Assignment using a Rubric.	
Final Exam (UAS)								**30%**

B. Practicum

Week	Expected Final Competence – Sub-CPMK	Learning Material	Learning Method	Estimated Time	Student Learning Experience	Indicators	Assessment Criteria	Scoring Weight
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	Having an understanding and being able to apply safety measures in the chemical laboratory, handling the management	- Explanation of laboratory rules - Health and Laboratory Work Safety	- Lecture, - Video presentation	170’	a. Obtaining insights and explanations about the procedures and	90% of the students adhere and follow the laboratory procedures and regulations	Discipline and compliance with the established rules in the laboratory and	**0%**

	of laboratory chemical waste, and adhering to laboratory work rules.				rules of laboratory activities, as well as the necessary preparations for participating in practical work.	diligently during the practical work.	during practical work.	
2	a. After completing the laboratory practice on the topic of Introduction to Laboratory Safety Equipment, students are expected to: (1). Be able to use commonly used glassware in the chemistry laboratory. (2). Identify the names and functions of laboratory equipment. (3). Apply basic laboratory techniques such as weighing, pipetting, accurately reading liquid volumes, and filtration. b. After completing the laboratory practice on the topic of Introduction to Chemical Substances, students are expected to: (1). Skillfully recognize symbols and hazard properties of chemical substances.	a. Introduction to Workplace Safety Equipment and Laboratory b. Introduction to Chemical Substances	a. Work Plan Preparation b. Procedure Explanation and Demonstration c. Laboratory Work d. Report Writing	30’ 10’ 100’ 30’	a. Obtaining knowledge and explanations about Health and Safety at Work b. Acquiring Skills in Using Glassware and Basic Instruments in the Chemistry Laboratory c. Obtaining knowledge and explanations about the Properties of Chemical Substances, Hazard Symbols, and Handling and Mitigating Hazards from Chemical Exposure.	75% of the students answered correctly and acquired skills in items a-c based on the assessment criteria.	a. Accuracy and completeness in creating a laboratory work plan b. Skills, activeness, and group cooperation c. Completeness and accuracy in data analysis and report writing.	**2,125%**

	(2). Read Material Safety Data Sheets (MSDS) effectively. (3). Differentiate types of bottles/containers for storing chemical substances. (4). Explain hazardous chemical reactions.							
3-7 (The material is rotated per group every week)	After conducting this experiment, students will be able to: (1) skillfully weigh and prepare solutions from solids, (2) skillfully perform dilutions of concentrated solutions, (3) skillfully determine the concentration of solutions using various units, (4) skillfully determine the solubility properties of a compound, and (5) skillfully use glassware, particularly pipettes and volumetric flasks.	Solution Preparation	a. Work Plan preparation b. Explanation of procedures and demonstration c. Laboratory work d. Report writing	30’ 10’ 100’ 30’	Skills in preparing solutions and calculating its concentration	75% of the students answered correctly and acquired the necessary skills according to the assessment criteria.	a. Accuracy and completeness in creating a laboratory work plan. b. Skills, activeness, and group collaboration. c. Completeness and accuracy in data analysis and report writing.	**2,125%**
	After conducting this experiment, the students are expected to: (1) be skilled in distinguishing ionic compounds from covalent compounds, (2) be able to explain the relationship between the type of bond and molecular structure to the properties of	Chemical Bonds: Ionic and Covalent	a. Work Plan Preparation b. Procedure Explanation and Demonstration c. Laboratory Work d. Report Writing	30’ 10’ 100’ 30’	Skills in conducting chemical bonding experiments, demonstrating the differences in physical and chemical properties of ionic and covalent compounds.	75% of the students answered correctly and acquired skills in the assessment criteria.	a. Accuracy and completeness in creating a laboratory work plan b. Skills, activeness, and group cooperation	**2,125%**

	compounds, (3) be skilled in assembling apparatus for determining the melting point and electrical conductivity of a substance.						c. Completeness and accuracy in data analysis and report writing.	
	After completing the Gas Law experiment, the students are expected to (1) have the skill to determine the final volume of a gas given the initial volume, initial temperature, and final temperature, using the formula derived from Charles's Law, and (2) have the skill to set up the experimental apparatus to demonstrate Charles's Law. After conducting the experiment on Phase Changes of Matter and the Energy Involved, the students will be able to (1) skillfully determine the phase changes of a substance, (2) proficiently read phase change diagrams of a substance, and (3) accurately calculate the energy changes associated with phase transitions of a substance.	a. Gas Laws b. Phase Changes of Matter and the Energy Involved	a. Work Plan Preparation b. Procedure Explanation and Demonstration c. Laboratory Work d. Report Writing	30’ 10’ 100’ 30’	a. Skills in conducting the Gas Law experiment, proving the influence of temperature changes on the measured volume of gas at constant pressure. b. Skills in conducting the experiment on the phase change of iodine and naphthalene substances, proving the phase changes of iodine and naphthalene solids at room temperature and atmospheric pressure, as well as the energy involved in these phase changes.	75% of the students answered correctly and acquired skills in items a and b according to the assessment criteria.	a. Accuracy and completeness in creating a laboratory work plan. b. Skills, activeness, and group collaboration. c. Completeness and accuracy in data analysis and report writing.	**2,125%**

	After completing this experiment, the students are expected to: (1) be skilled in predicting equilibrium shifts influenced by concentration and volume; (2) be skilled in recognizing chemical changes based on reactions; and (3) have basic skills in operating the Spectronic 20D+ instrument.	Chemistry Equilibrium	a. Work Plan Preparation b. Procedure Explanation and Demonstration c. Laboratory Work d. Report Writing	30’ 10’ 100’ 30’	Skills in conducting chemical equilibrium experiments, demonstrating the influence of reactant and product concentrations on equilibrium shifts.	75% of the students answered correctly and acquired skills based on the assessment criteria.	a. Accuracy and completeness in creating a laboratory work plan. b. Skills, activeness, and group collaboration. c. Completeness and accuracy in data analysis and report writing.	**2,125%**
	After conducting this experiment, the students will be able to: (1) skillfully detect the color differences between acids and bases; (2) proficiently perform a simple acid-base titration and accurately determine the end point; (3) effectively calculate the concentration of the acid-base titration product.	Acid-Base	a. Work Plan Preparation b. Procedure Explanation and Demonstration c. Laboratory Work d. Report Writing	30’ 10’ 100’ 30’	Skills in conducting acid-base experiments, using universal pH indicator to measure solution pH, determining the pH range of acid-base indicators, performing titration techniques, and determining the end point of titration.	75% of the students answered correctly and acquired skills based on the assessment criteria.	a. Accuracy and completeness in creating a laboratory work plan. b. Skills, activeness, and group collaboration. c. Completeness and accuracy in data analysis and report writing.	**2,125%**
8-12 (The material is rotated per group every week)	After conducting this experiment, the participants are expected to: (1) be able to explain the principle of buffer systems in buffer solutions; (2) demonstrate proficiency in using the Henderson-Hasselbalch equation to prepare buffer	Buffer	a. Work Plan Preparation b. Procedure Explanation and Demonstration c. Laboratory Work d. Report Writing	30’ 10’ 100’ 30’	Skills in conducting experiments on buffer solution preparation, using a pH meter (calibrating and measuring the pH of solutions), and determining the capacity/strength of a buffer solution.	75% of the students answered correctly and acquired skills based on the assessment criteria.	a. Accuracy and completeness in creating a laboratory work plan. b. Skills, activeness, and group collaboration. c. Completeness and accuracy in data	**2,125%**

	solutions with specific concentrations and pH values from the provided stock solutions; (3) be skilled in calibrating the pH meter prior to measuring the pH of solutions; (4) accurately measure the pH of solutions using a pH meter; (5) be able to determine the buffer capacity against the addition of strong acids or bases.						analysis and report writing.	
	After conducting this experiment, the participants are expected to: (1) be able to explain the influence of concentration, temperature, and catalyst on the rate of reaction; (2) demonstrate proficiency in identifying changes that occur in the mixture as evidence of a chemical reaction.	Chemical Kinetics	a. Work Plan Preparation b. Procedure Explanation and Demonstration c. Laboratory Work d. Report Writing	30’ 10’ 100’ 30’	Skills in conducting chemical kinetics experiments, proving the occurrence of changes as evidence of chemical reactions, and demonstrating the influence of rate-determining factors on the time and rate of reaction.	75% of the students answered correctly and acquired skills based on the assessment criteria.	a. Accuracy and completeness in creating a laboratory work plan. b. Skills, activeness, and group collaboration. c. Completeness and accuracy in data analysis and report writing.	**2,125%**
	After conducting this experiment, the participants will be able to: (1) skillfully identify metals that undergo reduction/oxidation reactions with water and acid; (2) skillfully identify	Redox Reactions	a. Work Plan Preparation b. Procedure Explanation and Demonstration c. Laboratory Work	30’ 10’ 100’ 30’	Skills in conducting reduction and oxidation (redox) reactions experiments, proving the occurrence of redox reactions, determining	75% of the students answered correctly and acquired skills based on the assessment criteria.	a. Accuracy and completeness in creating a laboratory work plan. b. Skills, activeness, and	**2,125%**

	metals that undergo reduction or oxidation reactions when reacted with other metal ions; (3) skillfully identify metals that are useful as anodes and cathodes to prevent corrosion; (4) understand simple applications of redox reactions in daily life; (5) skillfully assemble electrolysis experimental apparatus.		d. Report Writing		substances undergoing reduction and oxidation, and identifying metals as anode and cathode to prevent corrosion.		group collaboration. c. Completeness and accuracy in data analysis and report writing..	
	After conducting the experiment, the participants will be able to: (1) skillfully recognize simple models of molecules; (2) skillfully correlate molecular shape with dipole moment (polarity), bond strength, and bond angle; (3) skillfully demonstrate oxidation reactions with the help of molecular models.	Molecular Models	a. Work Plan Preparation b. Procedure Explanation and Demonstration c. Laboratory Work d. Report Writing	30’ 10’ 100’ 30’	Skills in conducting experiments with simple organic molecular models and DNA molecules.	75% of the students answered correctly and acquired skills based on the assessment criteria.	a. Accuracy and completeness in creating a laboratory work plan. b. Skills, activeness, and group collaboration. c. Completeness and accuracy in data analysis and report writing.	**2,125%**

	After conducting this experiment, the participants will be able to: (1) skillfully associate the structure of natural polymers with their properties; (2) skillfully demonstrate the physical changes of proteins due to denaturation; (3) skillfully demonstrate the process of water absorption changes in synthetic polymers qualitatively through treatment with acids, bases, and metal ions.	Polymers	a. Work Plan Preparation b. Procedure Explanation and Demonstration c. Laboratory Work d. Report Writing	30’ 10’ 100’ 30’	Skills in conducting polymer experiments, demonstrating changes in polymer structure due to environmental conditions.	75% of the students answered correctly and acquired skills based on the assessment criteria.	a. Accuracy and completeness in creating a laboratory work plan. b. Skills, activeness, and group collaboration. c. Completeness and accuracy in data analysis and report writing.	**2,125%**
13	Having the skills to conduct simple chemical experiments using readily available materials and equipment in the surrounding environment.	Self-Practicum Notes: Self-directed Practicum Topic in Chemistry	a. Group Discussion b. Hands-on Self-Practicum c. Creation of Self-directed Practicum Video Documentation d. Video Presentation	170’	a. Skills in conducting simple chemical experiments b. Group discussions c. Creating a video d. Video presentation	75% of the students performed correctly and acquired skills in criteria items a-d according to the assessment.	a. Accuracy of identity (name, date, title of the theme), b. Suitability of the systematic flow of the video creation, c. Completeness of the content in the organized video (completeness of the provided information, representing the material). Active participation, collaboration, responsibility,	**4,5%**

							discipline, accuracy, and completion in formulating questions and statements during interactive discussions. Notes: Assessment of Group Video Assignment using Rubric	
14	**PRACTICUM EXAM**							**5%**

Grading Design:

Learning outcomes	Practicum	Lecture Exam	
		Midterm Exam	Final Exam
1. Able to apply basic concepts, laws, and theories of chemistry as a foundation for scientific thinking in further studies in the fields of agriculture, marine science, and tropical biosciences.	√	√	√
2. Able to explain the concepts of modern chemistry, chemical equations and reaction products, chemical bonding, states of matter, solutions, chemical equilibrium, acids and bases, electrochemistry, chemical kinetics, organic molecules, and organic polymers.	√	√	√
3. Able to communicate and deliver ideas and opinions, while respecting the opinions of others.	√		
4. Able to use logic and critical thinking to solve problems.	√	√	√
5. Able to collaborate and collaborate in a laboratory setting, considering aspects of safety, health, and the environment.	√		

Scoring Weight:

Scoring Criteria	Score Range	Grading Weight (%)	Description

A. Lecture			
- Midterm Exam	0-100	30,00	Individual Score
- Final Exam	0-100	30,00	Individual Score
- Video Assignment	60-90	5,00	Group Score
B. Practicum			
- Work Plan	0-100	1,275	Individual Score
- Work	0-100	20,40	Individual Score
- Report	0-80	3,825	Individual Score
- Self-Practicum	60-90	5,00	Group Score
- Practicum Exam	0-100	4,50	Individual Score
Chemistry of Science and Technology Final Grade (KIM 1104 3(2-1))		**100**	

Lecture Video Assessment Rubric

Science and Technology Chemistry Video Assignment Assessment Sheet							
Class	:…….ST01……						
Group	:…….A……						
(Fill in the appropriate points in the light blue columns)							
No	**Indicators**	**Assessment Criteria**				**Point**	**Score**
		90	**80**	**70**	**60**		
Video Format and Quality Aspect (40%)							
1	File Size	<20 MB	20-30 MB	30-50 MB	>50 MB	60	24
2	Duration	1,5 - 2 minutes	2 - 3 minutes	>3 minutes		90	36
3	Image Quality	Clearly Visible	Less visible		Blurry/Not visible at all	90	36
4	Audio Quality	Clearly audible with suitable background music that does not overpower the narration (Full score: 90); If the audio is unclear, deduct 5 points; If the narration is unclear and too fast, deduct 10 points; If there is background music that disrupts or covers the narration, deduct 5 points; If there is no background music, deduct 10 points; If there is no sound at all (no audio), deduct 20 points; If there is background music but no narration, deduct 20 points.				70	28
5	Writing Quality	There is a clear title, group identity, and captions that can be read without interfering the video content (proportional font size) (Full score: 90); If there is no title, deduct 10 points; If there is no group identity, deduct 5 points; If the text is not clearly readable, deduct 5 points; If the text is not readable at all, deduct 10 points; If the font size is not proportional, deduct 5 points; If there is text being cut off, deduct 5 points.				85	34
					Average of Format and Quality aspect		**31.6**
Content Aspect (60%)							
1	Topic	Relevant			Irrelevant	90	54
2	Flow	Good (systematic presentation order)		Bad		90	54
3	Creativity and Originality	100% Self-recorded images.	Animation or video compilation	PPT slides with audio narration		70	42
					Average score for Content aspect		**50**
						Total Score	**81.6**

Submission Time (Fill in with the number "1" in the cell next to the appropriate submission time).		**Final Score**
On-Time	1	***81.6***
One day late		***0***
Two days and more late		***0***

Self-Practicum Assessment Rubric

SELF-PRACTICUM VIDEO ASSESSMENT RUBRIC - KIM ST (EVEN) 2020-2021

No	Indicator	Assessment Points 90	80	70	60	Points	Score
		Presentation and Format Quality					
1	File Size of the Video:	Max 50 mb	50-70 mb	70-90 mb	>90 mb	80	32
2	Video Duration	Max 5 minutes	5-6 minutes	6-7 minutes	>7 minutes	80	32
3	Video Quality + Caption (Title, Group, subtitles if available)	The video is clearly visible and the captions are clear.	The video is clearly visible and the captions are clearly visible as well.	The video is less clear and the captions are not clear or blurry.	The video is not clear and the captions are not clear or disrupting the video.	80	32
4	Audio Quality	The audio is clear and suitable for the flow of the video.	The audio is clear, but it isn't quite suitable for the flow of the video.	The audio is unclear and isn't suitable for the flow of the video.	Unclear and not consistent with the flow of the video.	80	32
		Presentation and Format Score.					32
		Content Quality					
1	Relevance of the Topic to the Video Created.	Relevant. (The topic is relevant with the video created).	Slightly irrelevant. (The topic and the video created are irrelevant).	[redacted]	Not relevant at all. (The topic and the video created are not relevant to each other).	70	42
2	Logical Flow of the Video.	Excellent. (Explains the scientific aspects of chemistry that are relevant to the chosen topic clearly and well).	Good. (The chemical aspects are explained adequately regarding the chosen topic).	Adequate (the explanation in the video lacks incorporating sufficient aspects of chemistry related to the topic)	Insufficient (the video explanation does not/incorporates few aspects of chemistry knowledge).	70	42
3	Procedure Demonstration	Individual Experiment	Combination of Recording-Animation or Full Animation	Video compilation	[redacted]	70	42
		Content Score					42
		Format + Content Score					74
		On-time submission (write the number "1" in the appropriate column and "0" in the other two columns)					
	Submission Time	On time = 100%				1	74
		1-2 days late = 80%				0	0
		>2 days=50%				0	0
		Video score based on on-time submission					74
		Evaluation of videos from other groups					
	Evaluation from Other Groups	Evaluation from other groups; excellent = 90; good = 80; fair = 60				60	60
		VIDEO SCORE					**67**

SELF-PRACTICUM VIDEO ASSESSMENT RUBRIC - KIM ST (EVEN) 2020-2021

No	Indicators	Assessment Points 90	80	70	60	Points	Score
	Discussion during the presentation						
1	Discussion: Evaluation of **Answers to Questions from other groups** (Mandatory)	The answer provided is correct, good, and well-structured related to the scientific topic that are appropriate and relevant to the topic and the question asked by the questioner.	The answer provided is accurate, good, and well-structured, but it lacks sufficient relevance to the scientific topic and the question asked by the questioner.	The answer provided is not quite accurate, not well-presented, and lacks structure in relation to the scientific topic and the question asked by the questioner.	The answer provided is highly inadequate in terms of structure and scientific relevance to the topic and the question asked by the questioner.	60	60
2	Discussion: Evaluation of **questions to other groups** (mandatory)	Question or comment is focused, well-structured, and relevant to the chosen topic by the presenter.	The question or comment is well-focused and well-structured, but it lacks relevance to the chosen topic by the presenter.	The question or comment is not well-focused and poorly structured, and it lacks relevance to the chosen topic by the presenter.	The question or comment is not structured and not related to the topic chosen by the presenter.	60	60
3	Discussion: Additional points for providing relevant **discussion to other groups beyond their assigned task** (bonus points)	Directed/structured questions or comments that are relevant to the chosen topic and demonstrate good knowledge = 10 bonus points	Directed/structured questions or comments that are somewhat relevant to the chosen topic but lack in-depth knowledge = 5 bonus points	Unfocused/unstructured questions or comments that are not closely related to the chosen topic by the presenter = 3 bonus points	Unstructured and unrelated questions or comments that are not related to the chosen topic by the presenter = 1 bonus point.	10	10
							70
	Contribution (Assessment directly by peers and given directly to the assistant via a link)						
1	Contribution within the group (Self-assessment)	Active = 90	Less active = 60	[redacted]	Inactive = 30	75	75
	Final Grade for Independent Practical Assignment						**68.4**

Notes:
1. This grade is an individual grade.
2. If sub-group members are not active in the discussion, their grade will only be based on the video and peer assessment.
3. The assistant encourages all sub-group members to actively participate in the discussion so that all members can earn this point.

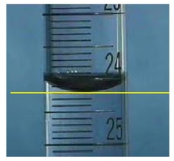
Practicum Report Assessment Rubric Example:

PRACTICUM REPORT ASSESSMENT RUBRIC

Name/Student ID/Group:

Introduction to Basic Safety and Laboratory Equipment

Section/Part	Assessment Indicator/Answer	Max Score	Score
Identity	Each identity should be filled out completely, with each point worth 0.5.	3	0
Section I.a. Glassware			
Part 1	Be able to explain and name three glasswares correctly and precisely according to its name and function based on guide/video that have been watched	3	0
Part 2	Be able to mention the function and washing method of glassware completely, each step is written in the correct sequence, and logically coherent. In general, washing glassware is done by using soap+water. Use a brush if necessary to help remove sediments. Soak in acid+chromate for some time, then wash and rinse with tap water when the sediments are hard to remove. Lastly, rinse with distilled water (aquades).	5	0
Part 3	Be able to mention all types of high precision glassware [Burette, volumetric and mohr pipette, volumetric flask]. @answer worth 1 point	3	0

Part 4	Reasons on why spouts should be filled to the brink is answered correctly based on volume measurement precision of burette reading meniscus	3	0
Part 5.a	The correct answer regarding the accuracy of reading the burette meniscus is related to how quickly or slowly the liquid is released. Releasing the liquid quickly will cause the solution to stick and remain on the walls of the burette, resulting in inaccurate readings. Releasing the liquid slowly will make the meniscus reading more accurate	4	0
Part 5.b	There is a difference between a clear meniscus and a colored meniscus: The water meniscus (which is clear) is read using the lower meniscus, while the meniscus for KMnO4 (which is colored) is read using the upper meniscus.	5	0
Part 5.c	Rea is clear) is done usir the colored mer meniscus (as sho   Air $KMnO_4$	4	0

Section I.b. Burner

Part 1.a	The air vent serves as a place for air to enter and regulate the amount of air before it mixes with gas in the barrel.	4	0
Part 1.b	The main valve functions to regulate the amount of gas released from the gas source that will be burned in the gas burner.	4	0

Part 1.c	The spud is the place where gas exits and enters the barrel to be burned. The spud is located at the bottom of the barrel.	4	0
Part 2	A yellow flame is a flame that results from an improper ratio of gas and air, specifically a deficiency of air, resulting in incomplete combustion, lower temperature, and the formation of soot that can dirty the equipment.	4	0
Section II Pipetting and Reading Solution Meniscus			
Part 1	The following is the correct sequence of steps for pipetting: (1) Rinse with solution, (2) Draw up the solution above the tare mark using the bulb, (3) Wipe/dry the pipette tip with a tissue, (4) Tare the solution until the meniscus is parallel to the eye level, (5) Lower the pipette by keeping it vertical and tilting the container at a 45-degree angle (lower slowly), and (6) When finished, scratch the pipette tip several times against the container wall. The remaining liquid does not need to be expelled. This information can be checked in the guidance manual.	7	0
Part 2	Rinsing the pipette is necessary to avoid contamination with the previous solution.	5	0

Part 3	Which answer is better using the uncertainty approach? The uncertainty for a 1 mL pipette is ±0.006 mL and for a 5 mL pipette it is 0.01 mL. When using a 1 mL pipette three times, the result is 3 ± 0.0104 mL, while using a 5 mL pipette once produces a result of 3 ± 0.0100 mL. The difference is very small, so it can be said that they are not different, but the more practical option is to use a Mohr pipette once for 5 mL. The general formula can be seen in the following equation.	5	0
Part 4	The pipette should be held upright so that the meniscus is always aligned and in line with the tare mark, thus ensuring accurate volume readings.	4	0

Section III. Weighing

Part 1	Th[illegible] gui[illegible] he imp[illegible] bble is wit[illegible] the empty container, (3) closing the balance cover, and (4)	9	0
Part 2		4	0

Transfer Pipets		
	1	0.006
	2	0.006
	5	0.01
	10	0.02

Function	s_R
$R = kA$	$s_R = ks_A$
$R = A + B$	$s_R = \sqrt{s_A^2 + s_B^2}$
$R = A - B$	$s_R = \sqrt{s_A^2 + s_B^2}$

TOTAL SCORE	80	**0**

PRACTICUM REPORT ASSESSMENT RUBRIC

Name/Student ID/Group:

Introduction to Chemicals

Section/Part	Assessment Indicator/Answer	Max Score	Score
Identity	Each identity should be filled out completely, with each point worth 0.5.	4	0
Section I. chemical symbol			
Compound Table	Completing each column correctly according to the instructions in the table, each column is 1 point worth. The assistant may improvise within the guidebook of the video and laboratory guide.	25	
Section II. Introduction to Hazardous Chemicals			
Part 1.a	Observation results of damage caused by concentrated sulfuric acid (corrosive), for example, paper may catch fire or dissolve, and the speed of the process can be estimated by observing the relative time it takes for the tissue paper to catch fire.	5	
Part 1.b	Observation results of damage caused by concentrated potassium dichromate (oxidizing agent), such as direct burning or hole in the paper, and how fast the process occurs can be seen from the relative time it takes for tissue paper to be damaged.	5	

Part 1.c	Observation result of damage caused by the mixture of sulfuric acid (corrosive) + potassium dichromate (oxidizer), for example, paper immediately burns or corrodes and how fast the process is observed from the relative time it takes for the tissue paper to be damaged.	5
Part 1.d	Comment: When paper is exposed to a corrosive or oxidizing substance, what happens? If the substance has already been exposed to an oxidizer and is then followed by a corrosive substance, will the effect be stronger or not different? Theoretically, a material that has been exposed to an oxidizer and then to a corrosive substance will deteriorate faster because the corrosive and oxidizing substances will work synergistically to accelerate the damage.	8
Part 2. Table	Reaction table and observation results with each correct entry, each entry is worth 2 point: $2Na + 2H_2O \rightarrow 2NaOH + H_2$ $2K + 2H_2O \rightarrow 2KOH + H_2$	8
Part 2. Comments	This comment is related to the reactivity of alkali metals Na and K, the nature of the reaction (exo or endo thermic), and the result of the reaction which is the formation of a base.	8
Section III. Reagent Bottle		
Part 1.	The function of providing different colors to the bottles depending on the material's properties towards oxidation and the light that enters the stored material.	5

Part 2.	Types of bottle caps according to the guide, flat, round, beak, and flat. Functions and procedures according to the guidebook.	7	
TOTAL SCORE		80	**0**

PRACTICUM REPORT ASSESSMENT RUBRIC

Name/Student ID/Group:

Chemical Solution Preparation

Section/Part	Assessment Indicator/Answer	Max Score	Score
Identity	Each identity should be filled out completely, with each point worth 0.5.	4	0
Section I. Making Urea Solution from its Solid			
Fill-in-the-blank a to j	There are 10 fill-ins that must be completed, each worth 1.5 points.	15	
Part 1	To answer questions regarding concentration in moles per liter (M), the steps are: (1) writing the formula for molarity, (2) calculating molarity, and (3) writing down the result.	8	
Part 2	To answer questions regarding concentration in molality (m), the steps are: (1) writing the molality formula, (2) calculating the molality, and (3) writing down the result.	8	

Part 3	To answer a question regarding concentration in % w/w, the steps are: (1) writing the % w/w formula, (2) calculating the % w/w, and (3) writing the result.	8	
Part 4	To answer questions regarding concentration in %w/v, the steps are as follows: (1) write the formula for %w/v, (2) calculate %w/v, and (3) write down the result.	8	
Section II. Making KCl Solution			
KCl solution data	There are 4 data fields, each worth 3 points.	12	
Calculation	The calculation to find the concentration of KCl produced must be done by writing down the formula used, which is M1V1 = M2V2, writing down the calculation using the formula M1V1 = M2V2, and writing down the result in the unit of Molarity (M).	9	
Conclusion	The conclusion from the process of making urea from solids and KCl from diluting the stock solution is that the solution preparation can be done with different methods depending on the type of sample, and there are several steps that need to be followed to prepare the solution and calculate the concentration.	8	
TOTAL SCORE		80	**0**

PRACTICUM REPORT ASSESSMENT RUBRIC

lame/Student ID/Group

Chemical Bonding (Ionic and Covalent)

Section/Part	Assessment Indicator/Answer	Max Score	Score

Identity	Each identity should be filled out completely, with each point worth 0.5.	4	0
Section I. Comparison of Melting Point			
a. Covalent Compound	Details for urea and details for sucrose, 6 fields, @0.5 point each	3	
b. Ionic Compoud	Data for KCl, CaCl2, and MgSO4, 3 blank datas @0.5 each	1.5	
Comparison of Purity of Urea and Sucrose Samples	In general, to determine melting point is that for a pure compound, the melting point range will be narrow, while for an impure compound, the range will be wider.	5	
Reasons for Higher Melting Point of Ionic Compounds	An analysis on the phenomenon of the ionic bond having a higher melting point than the covalent bond is related to the strength of the electrostatic bond and the lattice energy of the ionic compound. Therefore, a higher temperature is required to melt an ionic compound.	5	
Section II. Phase			
Table of State of Matter	There are 6 empty cells in the table, with each cell worth 0.5 points	3	
Discussion	Discussion regarding the difference in the state of matter between covalent and ionic compounds, the reasons for the differences that occur, covalent compounds can have liquid and volatile states while ionic compounds do not have a volatile state.	5	
Section III. Solubility Comparison			

Solubility Observation Table	There are 18 empty cells in the table, with each cell worth 0.5 points	9
Do ionic compounds dissolve in CCl4?	The reason why ionic compounds do not dissolve in CCl4 is related to their ionic nature/electrostatic interactions and the nonpolar nature of CCl4 which has no polar interactions.	5
Covalent Compounds Dissolve in Water	The interaction of covalent compounds with water is related to polar-polar interactions and the formation of hydrogen bonds, if possible.	5
Ionic Compounds Dissolve in Water	When an ionic compound dissolves in water, the phenomenon of solvation will affect its solubility process. The negative ion will be approached by the H atom and the positive ion will be approached by the O atom.	5
Section IV. Electrical Coductivity		
Fill-in Table	There are 12 empty cells in the table, with each cell worth 0.5 points	6
Discussion	The discussion regarding electrical conductivity is explained by using the phenomena of ionization of electrolyte compounds, strong or weak electrolytes, or non-electrolytes/molecular compounds.	5
Section V. Flammability		
Fill-in Table	There are 6 blank cells table, each cell is worth 0.5.	3
Discussion	Discussion on the reasons why some compounds are easily combustible, such as covalent compounds, is related to the type of compound (ionic/covalent), strength of the compound's bond, volatility of the compound, and the reasons behind it.	5

Section VI. Odor Test			
Fill-in Table	There are 6 empty cells in the table, with each cell worth 0.5 points	3	
Discussion	Discussion regarding the odor test, for example, covalent compounds are more volatile, making them more likely to emit odor.	5	
Conclusion	What can you conclude regarding various tests related to the properties, state, and bond strength of covalent and ionic compounds?	2.5	
TOTAL SCORE		80	0

PRACTICUM REPORT ASSESSMENT RUBRIC

Name/Student ID/Group:

Chemical Kinetic

Section/Part	Scoring Indicator	Max Score	Score
Identity	Each identity should be filled out completely, with each point worth 0.5.	4	0
Section I. Effect of Concentration and Reaction Rate			
Table 1. Effect of HCLConcentration	There are 6 empty cells in the table, with each cell worth 0.5 points	3	

Discussion about table 1	The discussion is related to the effect of increasing HCl concentration. Does the increase in concentration lead to a faster formation of precipitate, resulting in a shorter observation time? The change in observation time indicates a relationship between concentration and reaction time.	6
Table 2. Effect of Na2S2O3 concentration	There are 6 empty cells in the table, with each cell worth 0.5 points	3
Discussion about table 2	The discussion is related to the effect of increasing Na2S2O3 concentration, whether the higher the concentration, the faster the precipitation formation, resulting in shorter observation time. The changing observation time indicates a relationship between concentration and reaction time.	6
Bagian II. Effect of temperature		
Table 1. Hcl+Na2S2O3 reaction	There are 9 empty cells in the table, with each cell worth 0.5 points	4.5
Discussion about table 1	Discussion related to the effect of temperature or reaction at different temperatures. Theoretically, an increase in temperature will increase the reaction rate.	6
Table 2. Oxalate + Permanganate Reaction	There are 9 empty cells in the table, with each cell worth 0.5 points	4.5
Discussion about table 2	Discussion related to the presence of a catalyst, theoretically a catalyst will accelerate the reaction, and at the end of the reaction, there will be no more catalyst compound left.	6

Section III. Effect of Catalyst			
Fill-in table of Catalyst and autocatalyst	There are 8 empty cells in the table, with each cell worth 0.5 points	4	
Discussion	Discussion related to the effect of catalysts and autocatalysts on reaction kinetics. Theoretically, a catalyst will accelerate the reaction.	6	
Section IV. Conclusion			
Conclusion	In this conclusion, the relationship between the reaction kinetics and changes in the concentrations of HCl, Na2S2O3, and the presence of catalysts/autocatalysts can be written.	6	
Questions			
Part 1	The effect of temperature on reaction rate, temperature will increase molecular energy, and temperature will also increase the k value	7	
Part 2	The effect of catalyst on reaction rate: the catalyst will decrease the activation energy of the reaction and accelerate the reaction towards equilibrium/final point.	7	
Part 3	The factors that influence the reaction rate besides concentration, temperature, and catalyst are the surface area of molecules and the type of molecules	7	
TOTAL SCORE		80	0

PRACTICUM REPORT ASSESSMENT RUBRIC

Name/Student ID/Group:

Polymer

Section/Part	Scoring Indicator	Max Score	Score
Identity	Each identity should be filled out completely, with each point worth 0.5.	4	0
Section I. Rubber			
a. Initial Measurement	There are 12 fields that must be filled in, with each field worth 0.5 point	6	
b. Measurement After Soaking for a Certain Period of Time	There are 12 fields that must be filled in, with each field worth 0.5 point	6	
c. Overall Measurement	There are 12 fields that must be filled in, with each field worth 0.5 point	6	
Discussion	Discussion related to the properties of polymers that can undergo a swelling process when immersed in certain solutions, causing them to increase in size. The degree of swelling of a polymer is influenced by various factors such as the type of polymer and the contact time with the solution. Once the maximum contact time is reached, the swelling process will reach its maximum size or capacity.	10	
Section II. Protein			
Observation Table of Protein Reaction Results	There are 3 cells in the table that need to be filled, with each cell worth 2 points	6	

Discussion on Protein Reaction	Protein is a natural polymer that will undergo denaturation when it reacts/interacts with acid/base (pH changes), heat, and heavy metals, resulting in the destruction of its three-dimensional structure.	10	
Section III. Sodium Polyacrylate			
Question 1	In relation to the ability to swell due to interaction with water, the compound will experience swelling. Water will enter the polymer and become trapped, causing it to swell.	8	
Question 2	The presence of heavy metals in the water absorbent material made of sodium polyacrylate will decrease its swelling capacity. Heavy metals have an impact on the ability of a polymer to swell, resulting in a decrease in its swelling capacity.	8	
Question 3	The influence of neutral, acidic, or basic solutions on the swelling process can be well explained in relation to water absorption by sodium polyacrylate.	8	
Conclusion			
Conclusion	Regarding the polymer's ability to swell or absorb solvents and the factors that influence the swelling process that occurs.	8	
TOTAL SCORE		80	0

Recommended Mandatory and Supporting Books:

1. Chang R. 2003. *General Chemistry: The Essential Concepts*. Boston (US): McGraw Hill.
2. Timberlake. 2015. *Chemistry: An Introduction to General, Organic, and Biological Chemistry*. San Francisco (US): Pearson Benjamin Cummings.
3. Suchocki. 2007. *Conceptual Chemistry: Understanding Our World of Atoms and Molecules*. San Francisco (US): Pearson Benjamin Cummings.