	Universitas Negeri Surabaya **Faculty of Mathematics and Natural Sciences** **Undergraduate Chemistry Education Study Program**	**Document Code**

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Basic chemistry	8420403121	Compulsory Study Program Subjects	**T=3**	**P=0**	**ECTS=4.77**	1	July 17, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model	**Project Based Learning**	
Program Learning Outcomes (PLO)	**PLO study program which is charged to the course**	
	PLO-9	Mastering the principles of K3 (Work Safety and Security), managing the laboratory and using its equipment as well as how to operate chemical instruments (CPL 3)
	PLO-11	Able to demonstrate knowledge related to theoretical concepts about structure, dynamics and energy, as well as basic principles of separation, analysis, synthesis and characterization of chemicals (CPL 1)
	Program Objectives (PO)	
	PO - 1	Utilize learning resources and ICT to support mastery of Basic Chemistry concepts and theories.
	PO - 2	Make decisions about the relationship between basic chemical concepts and laboratory activities and the existence of chemistry in everyday life
	PO - 3	Have knowledge of the basics of chemistry including Stoichiometry, Atomic Structure & Periodic System of Elements, Chemical Bonding, Solutions, Colloidal Systems, Energetics, Reaction Rates, Chemical Equilibrium, Redox & Electrochemistry, Organic Chemistry, and Green Chemistry
	PO - 4	Have an honest and responsible attitude in carrying out lectures and practicums.
	PLO-PO Matrix	

P.O	PLO-9	PLO-11
PO-1		
PO-2		
PO-3		
PO-4		

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PO-1																
PO-2																
PO-3																
PO-4																

Short Course Description	Study of basic concepts: Stoichiometry, Atomic Structure & Periodic System of Elements, Chemical Bonding, Solutions, Colloidal Systems, Energetics, Reaction Rates, Chemical Equilibrium, Redox & Electrochemistry, Organic Chemistry, and Green Chemistry as well as appropriate laboratory activities through discussions, assignments, and practicums.	
References	**Main :**	

1. Tim Kimia Dasar. 2017. Kimia Umum . Surabaya: Unesa University Press.
2. Tim Kimia Umum. 2017. Kimia Umum . Surabaya: Unesa University Press.
3. Chang, Raymond. 2005. General Chemistry The Essential Concepts Third Edition. USA: McGraw Hill.
4. Tim Kimia Dasar. 2014. Kimia Umum . Surabaya: Unesa University Press.
5. Brady and Humiston. 2004. General Chemistry, Principles and Structures . New York: John Willey and Sons.

Supporters:

	1. Achmad, Hiskia dan Tupamahu. 1990. Penuntun Belajar Struktur Atom, Struktur Molekul, Sistem Periodik. Bandung: ITB. 2. Achmad, Hiskia dan Tupamahu. 1991. Stoikiometri dan Energetika Kimia, Bandung, PT Citra Aditya Bakti. 3. Ahmad, Hiskia. 1990. Kimia Larutan. Bandung: Jurusan Kimia FMIPA ITB
Supporting lecturer	Prof. Dr. Harun Nasrudin, M.S. Prof. Dr. Utiya Azizah, M.Pd. Dr. Mitarlis, S.Pd., M.Si. Rusly Hidayah, S.Si., M.Pd. Muhammad Nurrohman Sidiq, S.Si., M.Sc., Ph.D. Findiyani Ernawati Asih, S.Pd., M.Pd.

Week-	**Final abilities of each learning stage (Sub-PO)**	**Evaluation**		**Help Learning, Learning methods, Student Assignments, [Estimated time]**		**Learning materials [References]**	**Assessment Weight (%)**
		Indicator	**Criteria & Form**	**Offline (*offline*)**	**Online (*online*)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Apply the things that underlie stoichiometry, namely: basic laws of chemistry, atoms and molecules, the concept of moles and Avogadro's constant, compound formulas, chemical reactions as well as molarity and equivalence to complete chemical calculations	1.Explain the basic laws of chemistry 2.Explain the differences between Atoms, Molecules, and Mole Concepts 3.Applying Avogadro's Constant and Compound Formulas	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Performance assessments and practicum assessments are carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities	1. Interactive discussion 2. Practice questions 3 X 50	Practice questions on the basic laws of chemistry, atoms and molecules, the concept of moles and Avogadro's constant, compound formulas	**Material:** Stoichiometry: Basic Laws of Chemistry, Atoms and Molecules and the Mole Concept, Avogadro's Constant, and Compound Formulas **Library:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	5%
2	Apply the things that underlie stoichiometry, namely: basic laws of chemistry, atoms and molecules, the concept of moles and Avogadro's constant, compound formulas, chemical reactions as well as molarity and equivalence	1.Applying Chemical Reactions and Balancing, Molarity and Equivalence in practice questions 2.Report how to use and operate equipment according to basic chemistry practicum 3.Carrying out chemical separation experiments, Laovisier's Law and chemical reactions by applying K3 principles	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Practical assessments and performance assessments are carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities, Practical Assessment	1. Discussion 2. Assignments 3. Concept map learning strategies 4. Practicum 3 X 50	Practice questions about chemical reactions as well as molarity and equivalence to complete chemical calculations	**Material:** Stoichiometry: Chemical Reactions and Balancing, Molarity and Equivalence **Library:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	5%
3	Analyze the development of the discovery of the basic atomic particles according to Rutherford, Bohr, wave mechanics and electron configuration as well as the development, use, basis for the preparation of the periodic system and its relationship with the electronic configuration of elements and periodic properties	1.Explain the basic particles that make up atoms 2.Analyze the development of atomic theory 3.Determine the quantum numbers of various atoms 4.Determine the electronic configuration of various atoms	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Performance assessment is carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities	1. Interactive discussion, 2. Case method 3. Practice questions 3 X 50	Explore the underlying case example – the development of atomic theory	**Material:** Atomic Structure: Basic Particles, Hydrogen Atom Spectrum and Rutherford Atomic Model, Bohr Atomic Model, Wave Mechanics Atomic Model, and Electron Configuration **Library:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	5%

4	Analyze the development of the discovery of the basic atomic particles according to Rutherford, Bohr, wave mechanics and electron configuration as well as the development, use, basis for the preparation of the periodic system and its relationship with the electronic configuration of elements and periodic properties	1. Explain the development of the Periodic System of Elements and the relationship between electron configurations 2. Analyze various periodic properties	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Performance assessment is carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities	Case method; Group task; Presentation; Questions and answers 3 X 50	Explore the underlying case example – the development of the Periodic System of Elements	**Material:** Periodic System of Elements: Development of the Periodic System, Electron Configuration, Periodic Properties (Atomic Radius, Ionization Energy, Electron Affinity and Electron Reactivity) **Library:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	5%
5	Identify the relationship between chemical bonds and chemical forces to explain knowledge according to the study program.	1. Determining Ionic Bonds, Covalent Bonds, Bond Energy, and Other Chemical Bonds (van.der Waals, Hydrogen Bonds, Metallic Bonds) and their relationship to the properties of substances 2. Describes the resonance structure of a molecule 3. Determining the shape and polarity of a molecule based on the Valence Shell Electron Pair Repulsion Theory or hybridization theory. 4. Determine bond order through orbital energy level diagrams of various diatomic molecules	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Performance assessment is carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities	Interactive discussion; Group Assignment 3 X 50	Exploration of material related to the shape and polarity of a molecule	**Material:** Chemical Bonds: Ionic Bonds, Covalent Bonds, Molecular Structure, Metallic Bonds, and Chemical Forces (London vd Waals Forces, Hydrogen Bonds). **References:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	5%
6	Analyze several aspects of the solution and apply them in quantitative terms	1. Calculate various concentrations of solutions 2. Determine the colligative properties of electrolyte and non-electrolyte solutions. 3. Differentiate acid-base theory 4. Calculate the pH of the solution.	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Performance assessment is carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities	Case method, interactive discussion, and 3 X 50 group assignments	Explore the underlying case example – the development of the theory of acids and bases	**Material:** Solution: Solution concentration, colligative properties, acids - bases, and solution pH **Library:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	5%
7	Analyze several aspects of the solution and apply them in quantitative terms	1. Analyze ion equilibrium in salt solutions and relate their pH. 2. Determine working principles, pH calculations and the role of buffer solutions in life. 3. Determine the pH indicator path. 4. Analyze data from various types of acid-base titrations 5. Perform acid-base titration experiments	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Practical assessments and performance assessments are carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities, Practical Assessment	Case studies; Interactive discussion; Group task; Practical 3 X 50	Explore case examples related to the role of buffer solutions in life	**Material:** Solutions: hydrolysis, common ions, buffer solutions, indicators and titration. **References:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	5%

8	Midterm exam	Meeting assessment indicators 1 to 7	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Performance assessment is carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities, Tests	Scheduled offline 3 X 50	There isn't any	**Material:** Material for meetings 1 to 7 **Reference:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	15%
9	Analyze the principles underlying colloid systems and relate them to everyday symptoms	1. Describe the dispersion system 2. Analyze types of colloids 3. Differentiate between making colloids 4. Describe the uses of colloids	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Performance assessment is carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Case method, group assignments, presentations, and questions and answers 3 X 50	Exploration of case examples related to the manufacture and use of colloids in everyday life –	**Material:** Colloid Systems: definition, dispersion systems, classification of colloids, types of colloids, properties of colloids, making colloids, and uses of colloids. **References:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	5%
10	Describe the terms, laws of thermodynamics, and determine the occurrence of reactions thermodynamically	1. Describe the differences between system, environment, state function, adiabatic process, isotherm process, work, and heat capacity. 2. Applying the First Law of Thermodynamics, Hess's Law, and Bond Energy in calculations 3. Applying Thermochemical equations, Second Law of Thermodynamics, Entropy, Free Energy in calculations. 4. Carrying out thermochemical experiments	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Practical assessments and performance assessments are carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities	Case method, interactive discussion, group assignments, and 3 X 50 practicum	Explore case examples related to the application of the laws of thermodynamics in life	**Material:** Energetics: Several Terms (System, environment, state function, adiabatic process, isotherm process, work, heat capacity, etc.), First Law of Thermodynamics, Hess's Law, Bond Energy, Thermochemistry, Hk. II Thermodynamics, Entropy, and Free Energy. **References:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	5%
11	Analyze the concepts underlying the kinetics of a chemical reaction, namely rate, order and reaction mechanism	1. Explain the speed law 2. Explain the factors that influence the rate of a reaction, 3. Explain activation energy, reaction order, collision theory, and chemical reaction mechanisms.	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Practical assessments and performance assessments are carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities, Practical Assessment	Case method, interactive discussion, group assignments, and 3 X 50 practicum	Explore case examples related to the application of the reaction rate law in life	**Material:** Reaction Rate: Rate Law, Factors that Influence Reaction Rate, Activation Energy, Reaction Order, Collision Theory, and Chemical Reaction Mechanisms. **References:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	5%

12	Describe the laws of chemical equilibrium, Le Chatelier's principle and the use of equilibrium principles in industry	1. Explain how equilibrium reactions occur 2. Lowering the equilibrium constant 3. Explain the relationship between ΔGo and Kp and Kc 4. Explain the existence of equilibrium disturbances 5. Explain the application of the principle of equilibrium in industry	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Practical and performance assessments are carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities	Case method, interactive discussion, group assignments, and 3 X 50 practicum	Explore case examples related to the application of the law of equilibrium in life	**Material:** Chemical Equilibrium: Dynamic equilibrium, Equilibrium law, Le Chatelier's Principle (Effect of concentration, volume/pressure, temperature, catalyst), Use of Equilibrium in Industry **Library:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	5%
13	Analyze the role of reduction and oxidation in electrochemical events	1. Compare several redox concepts. 2. Explain Galvanic/Voltaic cells 3. Explain electrolysis 4. Predicting the spontaneity of redox reactions 5. Doing practicum	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Practical and performance assessments are carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities	Case studies, group assignments, presentations, and questions and answers 3 X 50	Explore case examples related to the application of reduction and oxidation reactions in life	**Material:** Electrochemical Oxidation-Reduction: redox concepts, balancing redox reactions, electrochemical cells, hydrogen electrode potential, DGL cells and the Nernst equation, electrolysis and quantitative aspects, corrosion. **References:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	5%
14	Describe carbon chemistry and relate it to everyday life	1. Describe the peculiarities of the carbon atom 2. Describe the classification and characteristics of organic compounds 3. Analyze the characteristics of each type of hydrocarbon (saturated, unsaturated, aromatic and substituted)	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Performance assessment is carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities	§ Interactive discussion § Group assignment 3 X 50	Exploration of material related to the classification and characteristics of organic compounds	**Material:** Carbon Chemistry: Specificities of the carbon atom, classification and characteristics of organic compounds, and types of hydrocarbons (saturated, unsaturated, aromatic and substituted) **Library:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	5%
15	Analyze the principles that support green chemistry	1. Explain the principles that support green chemistry 2. Analyze examples of the application of green chemistry that can be accessed via the internet	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Performance assessment is carried out in an integrated manner with learning **Form of Assessment** : Participatory Activities	Case method, interactive discussion, and 3 X 50 group assignments	Explore case examples related to the application of green chemistry	**Material:** Green Chemistry: supporting principles. **References:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	5%

16	Final exams	Assessment Indicators pert 9 to 15	**Criteria:** Participation with a weight of 20%; Tasks with a weight of 30%; UTS with a weight of 20%; UAS with a weight of 30%; UTS and UAS use Essay questions; Performance assessment is carried out in an integrated manner with learning **Form of Assessment** : Test	Scheduled offline	There isn't any	**Material:** All material from 9 to 15 **Library:** *Basic Chemistry Team. 2017. General Chemistry. Surabaya: Unesa University Press.*	15%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	67.5%
2.	Project Results Assessment / Product Assessment	2.5%
3.	Practical Assessment	7.5%
4.	Test	22.5%
		100%

Notes

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** abilities in the process and student learning outcomes are specific and measurable statements that identify the abilities or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.