	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 Inorganic Theory	8420403315	Compulsory Study Program Subjects	T=3	P=0	ECTS=4.77	3	July 17, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Prof. Dr. Sari Edi Cahyaningrum, M.Si., Dr. Amaria, M.Si., Dina Kartika Maharani, S.Si., M.Sc., Amalia Putri Purnamasari, M.Si.	Prof. Dr. Achmad Lutfi, M.Pd.	Prof. Dr. Utiya Azizah, M.Pd.

Learning model: Case Studies

Program Learning Outcomes (PLO)

PLO study program which is charged to the course

PLO-7	Applying logical, critical, systematic and innovative thinking in the context of the development or implementation of science, technology and art that pays attention to and applies humanities values appropriate to the field of chemistry education in solving problems (CPL 5)
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 Inorganic Chemistry concepts and theories
PO - 2	Have knowledge about the periodic properties of elements, acid-base theory, the basics of chemical reactions, thermodynamics and redox reactions, molecular structure: covalent bonds, ionic bonds and solid systems.
PO - 3	Make decisions in linking the concepts of conservation of elemental properties with acid-base theory, the basics of chemical reactions, thermodynamics and redox reactions, covalent bonds, ionic bonds and solid systems
PO - 4	Have an honest and responsible attitude in studying inorganic chemistry concepts

PLO-PO Matrix

P.O	PLO-7	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 the periodicity of elemental properties, covalent bonds, ionic bonds, chemical forces, acid-base theory, basics of chemical reactions, thermodynamics and redox reactions, and solid systems in group collaboration forums with discussion activities.

References

Main :

1. Huheey, J. E. ; Keiter, E. A. ; Keiter, R. L. , 1990, Inorganic Chemistry, Principles of Structure and Reactivity, Fourth Edition, Harper Collins College Publishers.
2. Madan, R. D. , 1997. Modern Inorganic Chemistry, S. Chand and Company LTD, NewDelhi.
3. Manku, G. S. , 1980,Theoritical Principles ofInorganik Chemistry,Tata Mc GrawHill Book Co of India. Arends, Richard I. (2004).Guide to Field Experiences and Portofolio Development: to accompany; learning to teach.New York: McGraw-Hill Book Company.
4. Sugiarto, Bambang. 2012. Sistem Periodik Unsur. Surabaya: Penerbit Unesa
5. Sari Edi Cahyaningrum, 2018, Teori Dasar Kimia Anorganik, Unesa University Press

Supporters:	

Supporting lecturer	Dr. Amaria, M.Si. Prof. Dr. Sari Edi Cahyaningrum, M.Si. Dr. Dina Kartika Maharani, S.Si., M.Sc. Amalia Putri Purnamasari, S.Si., M.Si. Herry Wijayanto, S.Pd., M.Sc., D.Sc.

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	Can explain the basic theories of the periodic properties of elements	1. Explain the meaning of effective core content 2. Explain the periodicity of ionization energy and the factors that influence it 3. Explain the periodicity of electron affinity and the factors that influence it 4. Explain the periodicity of electronegativity and the factors that influence it	**Criteria:** 1. Participation during lectures is carried out through observation with a weight of 20% 2. The Mid-Semester Examination (UTS) is carried out to access indicators from TM 1-7, through a written test and is given a weight of 20% 3. Structured assignment assessments are averaged, then given a weight of 30% 4. The Final Semester Examination (UAS) is used to measure indicators from TM 9-15, through a written test and the results are given a weight of 30% 5. Final Grade (NA) is 20% participation grade, 20% UTS grade, 30% assignment grade, and 30% UAS grade **Form of Assessment** : Participatory Activities	Presentation, Discussion and reflection. 3 X 50		**Matter:** Periodicity of elemental properties: Effective nuclear charge, Shielding effect, Ionization energy, Electron affinity, Electronegativity, Covalent and ionic radii; Chemical Bonds **Bibliography:** *Huheey, JE ; Keiter, EA ; Keiter, R.L., 1990, Inorganic Chemistry, Principles of Structure and Reactivity, Fourth Edition, Harper Collins College Publishers.*	3%

2	Analyze the basic theories of the periodic properties of elements	1. Explain the meaning of effective core content 2. Explain the periodicity of ionization energy and the factors that influence it 3. Explain the periodicity of electron affinity and the factors that influence it 4. Explain the periodicity of electronegativity and the factors that influence it	**Criteria:** 1. Participation during lectures is carried out through observation with a weight of 20% 2. The Mid-Semester Examination (UTS) is carried out to access indicators from TM 1-7, through a written test and is given a weight of 20% 3. Structured assignment assessments are averaged, then given a weight of 30% 4. The Final Semester Examination (UAS) is used to measure indicators from TM 9-15, through a written test and the results are given a weight of 30% 5. Final Grade (NA) is 20% participation grade, 20% UTS grade, 30% assignment grade, and 30% UAS grade **Form of Assessment** : Participatory Activities	Presentation, Discussion and reflection. 3 X 50		**Matter:** Periodicity of elemental properties: Effective nuclear charge, Shielding effect, Ionization energy, Electron affinity, Electronegativity, Covalent and ionic radii; Chemical Bonds **Bibliography:** *Huheey, JE ; Keiter, EA ; Keiter, R.L., 1990, Inorganic Chemistry, Principles of Structure and Reactivity, Fourth Edition, Harper Collins College Publishers.*	5%

3	Analyze the basic theories of the periodic properties of elements	1. Explain the meaning of effective core content 2. Explain the periodicity of ionization energy and the factors that influence it 3. Explain the periodicity of electron affinity and the factors that influence it 4. Explain the periodicity of electronegativity and the factors that influence it	**Criteria:** 1. Participation during lectures is carried out through observation with a weight of 20% 2. The Mid-Semester Examination (UTS) is carried out to access indicators from TM 1-7, through a written test and is given a weight of 20% 3. Structured assignment assessments are averaged, then given a weight of 30% 4. The Final Semester Examination (UAS) is used to measure indicators from TM 9-15, through a written test and the results are given a weight of 30% 5. Final Grade (NA) is 20% participation grade, 20% UTS grade, 30% assignment grade, and 30% UAS grade **Form of Assessment** : Participatory Activities	Presentation, Discussion and reflection. 3 X 50		**Matter:** Periodicity of elemental properties: Effective nuclear charge, Shielding effect, Ionization energy, Electron affinity, Electronegativity, Covalent and ionic radii; Chemical Bonds **Bibliography:** *Huheey, JE ; Keiter, EA ; Keiter, R.L., 1990, Inorganic Chemistry, Principles of Structure and Reactivity, Fourth Edition, Harper Collins College Publishers.*	5%

4	Analyze the different types of chemical bonds and the formation of covalent, coordination, ionic compounds	1. Explain the properties of ionic compounds 2. Explain the formation of ionic compounds 3. Explain the relationship between enthalpy changes and the solubility of ionic compounds 4. Uses Fajan's rule to explain the nature of bonds 5. Explain the formation of covalent bonds 6. Determine the structure/shape of molecules	**Criteria:** 1. Participation during lectures is carried out through observation with a weight of 20% 2. The Mid-Semester Examination (UTS) is carried out to access indicators from TM 1-7, through a written test and is given a weight of 20% 3. Structured assignment assessments are averaged, then given a weight of 30% 4. The Final Semester Examination (UAS) is used to measure indicators from TM 9-15, through a written test and the results are given a weight of 30% 5. Final Grade (NA) is 20% participation grade, 20% UTS grade, 30% assignment grade, and 30% UAS grade **Form of Assessment** : Participatory Activities	Presentation, Discussion and reflection. 3 X 50		**Matter:** Periodicity of elemental properties: Effective nuclear charge, Shielding effect, Ionization energy, Electron affinity, Electronegativity, Covalent and ionic radii; Chemical Bonds **Bibliography:** *Huheey, JE ; Keiter, EA ; Keiter, R.L., 1990, Inorganic Chemistry, Principles of Structure and Reactivity, Fourth Edition, Harper Collins College Publishers.* **Material:** Chemical Bonding: Introduction, Ionic Bonding: Properties of ionic compounds, formation of ionic compounds, ratio radius, lattice energy, solubility of ionic compounds, Fajan's rule, deviations of simple ionic structures **References:** *Madan, RD, 1997. Modern Inorganic Chemistry, S . Chand and Company LTD, New Delhi.*	3%

5	Analyze the different types of chemical bonds and the formation of covalent, coordination, ionic compounds.	1. Explain the properties of ionic compounds 2. Explain the formation of ionic compounds 3. Explain the relationship between enthalpy changes and the solubility of ionic compounds 4. Uses Fajan's rule to explain the nature of bonds 5. Explain the formation of covalent bonds 6. Determine the structure/shape of molecules 7. Determine the ionic character of covalently bonded molecules 8. Write down the molecular orbital theory	**Criteria:** 1. Participation during lectures is carried out through observation with a weight of 20% 2. The Mid-Semester Examination (UTS) is carried out to access indicators from TM 1-7, through a written test and is given a weight of 20% 3. Structured assignment assessments are averaged, then given a weight of 30% 4. The Final Semester Examination (UAS) is used to measure indicators from TM 9-15, through a written test and the results are given a weight of 30% 5. Final Grade (NA) is 20% participation grade, 20% UTS grade, 30% assignment grade, and 30% UAS grade **Form of Assessment** : Participatory Activities	discussion and questions and answers 3 X 50		**Material:** Chemical Bonding: Introduction, Ionic Bonding: Properties of ionic compounds, formation of ionic compounds, ratio radius, lattice energy, solubility of ionic compounds, Fajan's rule, deviation of simple ionic structures **References:** *Huheey, JE; Keiter, EA ; Keiter, R.L., 1990, Inorganic Chemistry, Principles of Structure and Reactivity, Fourth Edition, Harper Collins College Publishers.*	5%

6	Analyze the different types of chemical bonds and the formation of covalent, coordination, ionic compounds.	1. Explain the properties of ionic compounds 2. Explain the formation of ionic compounds 3. Explain the relationship between enthalpy changes and the solubility of ionic compounds 4. Uses Fajan's rule to explain the nature of bonds 5. Explain the formation of covalent bonds 6. Determine the structure/shape of molecules 7. Determine the ionic character of covalently bonded molecules 8. Write down the molecular orbital theory	**Criteria:** 1. Participation during lectures is carried out through observation with a weight of 20% 2. The Mid-Semester Examination (UTS) is carried out to access indicators from TM 1-7, through a written test and is given a weight of 20% 3. Structured assignment assessments are averaged, then given a weight of 30% 4. The Final Semester Examination (UAS) is used to measure indicators from TM 9-15, through a written test and the results are given a weight of 30% 5. Final Grade (NA) is 20% participation grade, 20% UTS grade, 30% assignment grade, and 30% UAS grade **Form of Assessment** : Participatory Activities	discussion and questions and answers 3 X 50		**Material:** Chemical Bonding: Introduction, Ionic Bonding: Properties of ionic compounds, formation of ionic compounds, ratio radius, lattice energy, solubility of ionic compounds, Fajan's rule, deviation of simple ionic structures **References:** *Huheey, JE; Keiter, EA ; Keiter, R.L., 1990, Inorganic Chemistry, Principles of Structure and Reactivity, Fourth Edition, Harper Collins College Publishers.*	5%

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8	Do UTS questions with the correct answers	Answer the UTS questions correctly	**Criteria:** The Mid-Semester Examination (UTS) is carried out to access indicators from TM 1-7, through a written test and is given a weight of 20% **Form of Assessment** : Test	Written test 3 X 50			20%

9	Analyze the principles of chemical reactions, acid-base theory, acid strength, dissolution processes, reactions in water and non-water solvents	1.1. Explain the occurrence of chemical reactions based on thermodynamic and kinetic aspects 2.2. Explain the differences in acid-base theory: Arrhenius, Bronsted Lowry, Lux-Flood, Usanofich, Lewis, soft hard acids and bases 3.3. Explain the process of dissolving compounds, both ionic and covalent 4.4. Explain the effect of temperature on solubility 5.5. Explain the mechanism of dissolving compounds in water 6.6. Explain the types of reactions based on the solvent	**Criteria:** 1.1. Participation during lectures is carried out through observation with a weight of 20% 2.2. Midterm Examination (UTS) is carried out to access indicators from TM 1-7, through a written test and is given a weight of 20% 3.3. Structured assignment assessments are averaged, then given a weight of 30% 4.4. The Final Semester Examination (UAS) is used to measure indicators from TM 9-15, through a written test and the results are given a weight of 30% 5.5. Final Grade (NA) is 20% participation grade, 20% UTS grade, 30% assignment grade, and 30% UAS grade **Form of Assessment** : Participatory Activities	discussion and questions and answers 3 X 50		**Material:** Chemical reactions: Basic principles of chemical reactions, acid-base theories, acid strength, dissolution processes, reactions in water and non-water solvents **References:** *Madan, RD, 1997. Modern Inorganic Chemistry, S. Chand and Company LTD, New Delhi.*	3%

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12	Analyzing oxidation-reduction reactions of inorganic compounds and predicting the magnitude of the reaction from electrode potential values	1.1. Explain several concepts of oxidation-reduction reactions 2.2. Predict the occurrence of a chemical reaction based on the value of the change in free energy from the electrode potential or oxidation potential 3.3. Distinguish between cell potential and electrode potential. The standard electrode potential values are given 4.4. Calculate the equilibrium constant of a reaction 5.5. Explain changes in pH and Eo values 6.6. Calculate Eo from the EMF diagram	**Criteria:** 1.1. Participation during lectures is carried out through observation with a weight of 20% 2.2. Midterm Examination (UTS) is carried out to access indicators from TM 1-7, through a written test and is given a weight of 20% 3.3. Structured assignment assessments are averaged, then given a weight of 30% 4.4. The Final Semester Examination (UAS) is used to measure indicators from TM 9-15, through a written test and the results are given a weight of 30% 5.5. Final Grade (NA) is 20% participation grade, 20% UTS grade, 30% assignment grade, and 30% UAS grade **Form of Assessment** : Participatory Activities	summarizing, discussion and questions and answers 3 X 50		**Material:** Oxidation and Reduction Reactions: Understanding oxidation-reduction reactions, half reactions, oxidation levels and oxidation numbers, driving forces for chemical reactions, oxidation potential, galvanic cells, potential. **Reference:** *Manku, GS, 1980, Theoretical Principles of Inorganic Chemistry, Tata Mc GrawHill Book Co of India. Arends, Richard I. (2004). Guide to Field Experiences and Portfolio Development: to accompany; learning to teach. New York: McGraw-Hill Book Company.*	3%

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14	Analyze solid system phenomena including ionic and covalent solids and their conductivity properties	1.1. Name the various crystal systems 2.2. Determine the Miler and Weiss index of a crystal plane 3.3. Determine the number of particles and particle volume in a crystal 4.4. Explain the use of Schottky and Frenkel defects as semiconductor materials 5. Explain the differences in the properties of conductors, insulators and semiconductors and super-conductors with band theory	**Criteria:** 1.1. Participation during lectures is carried out through observation with a weight of 20% 2.2. Midterm Examination (UTS) is carried out to access indicators from TM 1-7, through a written test and is given a weight of 20% 3.3. Structured assignment assessments are averaged, then given a weight of 30% 4.4. The Final Semester Examination (UAS) is used to measure indicators from TM 9-15, through a written test and the results are given a weight of 30% 5.5. Final Grade (NA) is 20% participation grade, 20% UTS grade, 30% assignment grade, and 30% UAS grade **Form of Assessment** : Participatory Activities	Create concept maps about solid systems, draw crystal planes, calculate Miller and Weiss indices Discuss and draw various types of ionic solids 3 X 50		**Material:** Solid Structure: Crystals and amorphous, Ionic solids, garphites and diamonds, defect structures, and band theory. **Reference:** *Manku, GS, 1980, Theoretical Principles of Inorganic Chemistry, Tata Mc Graw Hill Book Co of India.* *Arends, Richard I. (2004). Guide to Field Experiences and Portfolio Development: to accompany; learning to teach. New York: McGraw-Hill Book Company.*	3%

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16	do the UAS questions correctly		**Criteria:** 1.The Final Semester Examination (UAS) is used to measure indicators from TM 9-15, through a written test and the results are given a weight of 30% 2.Final Grade (NA) is 20% participation grade, 20% UTS grade, 30% assignment grade, and 30% UAS grade **Form of Assessment** : Test	3 X 50			30%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	50%
2.	Test	50%
		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.