LESSON PLAN OF ORGANOMETAL CHEMISTRY

UNESA	**UNIVERSITAS NEGERI SURABAYA** **FACULTY OF MATHEMATICS AND NATURAL SCIENCE** **UNDERGRADUATE PROGRAMME OF CHEMISTRY**	**Document Code**

SEMESTER LEARNING ACTIYITY PLAN

COURSE	CODE	Course Group	Credit Unit		Semester	Date
Organometal Chemistry	4720102162	Inorganic Chemistry	2	-	7th	

AUTHORIZATION	Compiler	Coordinator	Head of Study Program
CHEMISTRY	Dina Kartika Maharani, S.Si., M.Sc.	Dr. Ahmad Lutfi, M.Pd.	Dr. Amaria, M.Si.

Learning Outcomes	**Program Learning Outcomes (PLO)**	
	PLO 1 (KNO-1)	Able to master the concepts of structure, dynamics and energy, as well as the basic principles of separation, analysis, synthesis, and characterization of micromolecular compounds and their applications
	PLO 5 (COM-1)	Able to apply logical, critical, systematic and innovative thinking in the context of the development or implementation of science and technology by observe and applying the value of humanities in accordance with the field of chemistry in solving problems
	Course Learning Outcomes (CLO)	
	CLO1	Utilizing learning resources and ICT to support mastery of concepts and theories of organometallic compounds
	CLO2	Have knowledge of concepts, properties, similarities and differences between organometallic compounds and complex compounds (coordination compounds), structures and bonds, types of reactions and synthesis of organometallic compounds, use, stability and role of organometallic compounds in the environment.
	CLO3	Make conclusions and analyze concepts, properties, similarities and differences between organometallic compounds and complex compounds (coordination compounds), structures and bonds, types of reactions and synthesis of organometallic compounds, use, stability and role of organometallic compounds in the environment
	CLO4	Have a caring and responsible attitude in applying organometallic compounds in the environment
	Sub CLO	
	Sub-CLO1	Understand the meaning of organometallic compounds

	Sub-CLO2	Understand the general properties of organometallic compounds.
	Sub-CLO3	Understand the properties of organometallic compounds from the d block
	Sub-CLO4	Understand the synthesis, structure, properties and reactions of organometallic compounds
	Sub-CLO5	Understand the properties of organometallic compounds of the main group elements (s and p blocks).
	Sub-CLO6	Understand the nature and reactions of organometallic compounds in the environment.
	Sub-CLO7	Understand the types, reactions and uses of organometallic compounds
Brief Description of the Course	Study of concepts, properties, similarities and differences between organometallic compounds and complex compounds (coordination compounds), structures and bonds, types of reactions and synthesis of organometallic compounds, use, stability and role of organometallic compounds in the environment through providing information, reviewing journals, group discussions and presentations.	
Study Materials: Learning Materials	• The study of the concepts of organometallic compounds, • The properties of organometallic compounds, • Similarities and differences between organometallic compounds and complex compounds (coordination compounds), • structure and bonding, • Types of reactions and synthesis of organometallic compounds, • The use of organometallic compounds, • Stability and role of organometallic compounds in the environment.	
Reference	**Main :**	
	1. Shriver , D.F., Atkins,P.W. and Langford, C., 1990. Inorganic Chemistry, Oxford University Press, Tokyo. 2. Crabtree, Robert H, 1988. The Organometallic Chemistry of The Transition Metals, John Wiley & Sons, Singapore. 3. Douglas, B.E. ; McDaniel, D. H. ; Alexander, J.J., 1994. Concepts and Models of Inorganic Chemistry, Third Edition, John Wiley & Sons, Inc. New York. 4. Huheey, J.E. ; Keiter, E.A. ; Keiter, R.L., 1990, Inorganic Chemistry, Prinsciples of Structure and Reactivity, Fourth Edition, Harper Collins College Publishers.	
	Additional :	
	1. Organometal Chemistry Journal	
Lecturer	Prof. Dr. Sari Edi Cahyaningrum, M.Si. Dr. Amaria, M.Si. Dina Kartika Maharani, S.Si., M.Sc.	
Prerequisite courses	Have taken basic chemistry courses I, II, Inorganic Chemistry I, II, IV	

Meeting	The final ability of each activity	Assessment		Learning Forms, Learning Methods, Student Assignment		Reference	Rating Weight (%)
		Indicator	Criteria & Form	*Offline*	*online*		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Understand the meaning of organometallic compounds	• Explain Werner's theory of complex compounds about bonds and structures • Write the structure and isomers of complex compounds • Explain the trans complex effect of a planar quadrilateral • Predicting the product of a planar quadrilateral complex reaction • State the principle of hard and soft acids and bases • Describe the characteristics of hard and soft acids and bases • Predict the reaction direction • Predicting the order of reactivity of the ligands • Explain the theory of back bonding and electroneutrality	Essay Writing Test	Interactive discussion	–	1. Shriver , D.F., Atkins,P.W. and Langford, C., 1990. Inorganic Chemistry, Oxford University Press, Tokyo. 2. Crabtree, Robert H, 1988. The Organometallic Chemistry of The Transition Metals, John Wiley & Sons, Singapore. 3. Douglas, B.E. ; McDaniel, D. H. ; Alexander, J.J., 1994. Concepts and Models of Inorganic Chemistry, Third Edition, John Wiley & Sons, Inc. New York. 4. Huheey, J.E. ; Keiter, E.A. ; Keiter, R.L., 1990, Inorganic Chemistry, Prinsciples of Structure and Reactivity, Fourth Edition, Harper Collins College Publishers.	**10**

		• Describe back bonding with valence bond theory and molecular orbital theory					
2	Understand the general properties of organometallic compounds.	• Determine the valence electrons of the central metal atom • Counting the electrons of organometallic compounds • Determine the oxidation number of the central atom of an organometallic compound • Determine the oxidation number of the central metal atom of an organometallic compound • Write the molecular formula for the organometallic compound that has a high oxidation number	Essay Writing Test	Interactive discussion and exercise	–		**5**
3	Understand the properties of organometallic compounds from the d block	• Explain the equations of complex compounds with organometallic compounds • Explain the difference between complex compounds and	Essay Writing Test	Interactive discussion and individual task	–	1. Douglas, B.E. ; McDaniel, D. H. ; Alexander, J.J., 1994. Concepts and Models of Inorganic Chemistry, Third Edition, John Wiley & Sons, Inc. New York.	**5**

		organometallic compounds • Explain the bonding that occurs in carbon monoxide with the molecular orbital theory • Explain the nature of carbon monoxide ligands in organometallic compounds at the ends and bridge positions • Explain the phi acid properties of carbon monoxide ligands compared to other ligands				2. Huheey, J.E. ; Keiter, E.A. ; Keiter, R.L., 1990, Inorganic Chemistry, Prinsciples of Structure and Reactivity, Fourth Edition, Harper Collins College Publishers.	
4	Understand the synthesis, structure, properties and reactions of organometallic compounds	• Describe the synthesis of organometallic compounds with carbonyl ligands • Describe the synthesis of organometallic compounds with carbonyl ligands through reductive carbonylation • Describe the synthesis of organometallic compounds through oxidative addition	Essay Writing Test	Interactive discussion and individual task	–	1. Crabtree, Robert H, 1988. The Organometallic Chemistry of The Transition Metals, John Wiley & Sons, Singapore. 2. Huheey, J.E. ; Keiter, E.A. ; Keiter, R.L., 1990, Inorganic Chemistry, Prinsciples of Structure and Reactivity, Fourth Edition, Harper Collins College Publishers.	**5**

		• Explain the synthesis of organometallic compounds through reductive elimination • Explain the synthesis of organometallic compounds through insertion and elimination.					
5	Understand the synthesis, structure, properties and reactions of organometallic compounds	• Determine the structure of organometallic compounds • Determine the structure of organometallic compounds and the amount of CO based on IR data	Essay Writing Test	Interactive discussion and group task	–	1. Crabtree, Robert H, 1988. The Organometallic Chemistry of The Transition Metals, John Wiley & Sons, Singapore. 2. Huheey, J.E. ; Keiter, E.A. ; Keiter, R.L., 1990, Inorganic Chemistry, Prinsciples of Structure and Reactivity, Fourth Edition, Harper Collins College Publishers.	**10**
6	Understand the synthesis, structure, properties and reactions of organometallic compounds	• Explain the properties and reactions of organometallic compounds • Write an equation for the reaction for the manufacture of organometallic compounds	Essay Writing Test	Interactive discussion and group task	–	1. Crabtree, Robert H, 1988. The Organometallic Chemistry of The Transition Metals, John Wiley & Sons, Singapore. 2. Huheey, J.E. ; Keiter, E.A. ; Keiter, R.L., 1990, Inorganic Chemistry, Prinsciples of Structure and Reactivity, Fourth	**10**

						Edition, Harper Collins College Publishers	
7	Understand the properties of organometallic compounds of the main group elements (s and p blocks).	• Explain the difference between the main group organometallic compounds and hydrogen compounds • Explain the structure of organometallic compounds • Write the structure of organometallic compounds senyawa • Explain the synthesis of organometallic compounds from main group metals with haloalkanes, haloarenes, transmetallation, metathesis, and addition of E-H	Essay Writing Test	Interactive discussion and individual task	–	1. Crabtree, Robert H, 1988. The Organometallic Chemistry of The Transition Metals, John Wiley & Sons, Singapore. 2. Huheey, J.E. ; Keiter, E.A. ; Keiter, R.L., 1990, Inorganic Chemistry, Prinsciples of Structure and Reactivity, Fourth Edition, Harper Collins College Publishers.	**10**
8	**Mid-Term Exam**						
9	Understand the properties of organometallic compounds of the main group elements (s and p blocks).	• Explain the relative stability of organometallic compounds in one group • Explain the relative stability of organometallic compounds in one period.	Essay Writing Test	Interactive discussion and individual task	–	1. Crabtree, Robert H, 1988. The Organometallic Chemistry of The Transition Metals, John Wiley & Sons, Singapore. 2. Huheey, J.E. ; Keiter, E.A. ; Keiter, R.L., 1990, Inorganic Chemistry, Prinsciples of Structure	**10**

		• Explain the reactions of the main goal organometallic compounds and the results obtained • Describe electron-deficient organometallic compounds (act as Lewis acids) • Explain the mechanism of the reaction of organometallic compounds involving the elimination of hydrogen • Predicting the outcome of a reaction				and Reactivity, Fourth Edition, Harper Collins College Publishers.	
10	Understand the nature and reactions of organometallic compounds in the environment.	• Explain the occurrence of metal methylation in the environment • Explain the methylation reaction of mercury in the environment • Describe arsenic methylation in the environment	Essay Writing Test	Interactive discussion, group task. And presentation	–	Organometal Chemistry Journal	**10**
11	Understand the nature and reactions of organometallic compounds in the environment.	• Explain the occurrence of metal methylation in the environment • Explain the methylation reaction of mercury in the environment	Essay Writing Test	Interactive discussion, group task. And presentation	–	Organometal Chemistry Journal	**5**

		• Describe arsenic methylation in the environment					
12	Understand the nature and reactions of organometallic compounds in the environment.	• Explain the occurrence of metal methylation in the environment • Explain the methylation reaction of mercury in the environment • Describe arsenic methylation in the environment	Essay Writing Test	Interactive discussion, group task. And presentation	–	Organometal Chemistry Journal	**5**
13	Understand the types, reactions and uses of organometallic compounds	• Explain the structure and properties and uses of organosilicon compounds • Explain the structure and properties and uses of organoaluminium compounds • Explain the structure and properties and uses of organomagnetic compounds senyawa • Explain the structure and properties and uses of organolithium compounds • Explain the structure and properties and uses of organotin compounds.	Essay Writing Test	Interactive discussion, group task. And presentation	–	Organometal Chemistry Journal	**5**

14	Understand the types, reactions and uses of organometallic compounds	• Explain the structure and properties and uses of organosilicon compounds • Explain the structure and properties and uses of organoaluminium compounds • Explain the structure and properties and uses of organomagnetic compounds senyawa • Explain the structure and properties and uses of organolithium compounds Explain the structure and properties and uses of organotin compounds.	Essay Writing Test	Interactive discussion, group task. And presentation	–	Organometal Chemistry Journal	**5**
15	Understand the types, reactions and uses of organometallic compounds	• Explain the structure and properties and uses of organosilicon compounds • Explain the structure and properties and uses of organoaluminium compounds • Explain the structure and properties and uses of organomagnetic compounds senyawa • Explain the structure and properties and uses of	Essay Writing Test	Interactive discussion, group task. And presentation	–	Organometal Chemistry Journal	**5**

		organolithium compounds Explain the structure and properties and uses of organotin compounds.					
16	**Final Exams**						**100**