	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Bachelor of Science Education Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Atoms and Radioactivity	8420103171		T=3	P=0	ECTS=4.77	6	July 18, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Prof. Dr. Erman, M.Pd.

Learning model	**Case Studies**
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**
	Program Objectives (PO)
	PLO-PO Matrix

	P.O

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

Short Course Description	This course discusses atomic structure, symptoms of radioactivity, decay, half-life, binding energy, fission and fusion reactions, and elementary particles.
References	**Main :**

1. Arthur Beiser. 1987. Fisika Modern, Edisi Keempat. Jakarta: Erlangga. (Buku Terjemahan).
2. Michael F. LAnnunziata. 2007. Radioactivity: Introduction and History. Amsterdam: Elservier.
3. S.B. Pate. 1991. Nuclear Physics: An Introduction. New Delhi: New Age International Ltd.
4. Timberlake and Timberlake. 2011. Basic Chemistry, 3rd Edition. US: Pearson.

	Supporters:
Supporting lecturer	Prof.Dr. Wahono Widodo, M.Si. Ernita Vika Aulia, 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	Utilizing science and technology to search for data and information about atomic structures and as a tool to communicate the results of the search. Understand the concept of atomic structure based on Dalton and Thomson's atomic theory to analyze the weaknesses and strengths of the concept of atomic structure based on Dalton and Thomson's atomic theory. Able to make strategic decisions based on data and information to solve problems in learning about atomic structures. Responsible for self-learning, assignments, and agreements with colleagues.	1. Explain Dalton's postulates for the atomic concept. 2. Describe the concept of atoms according to Thomson. 3. Describe the concept of atoms according to Dalton. 4. Analyze the weaknesses and strengths of both atomic models.	**Criteria:** 1. 4: correct description 2. 3: the description is generally correct, there is one aspect where the explanation is incorrect 3. 2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4. 1: the description is wrong	Student-centered learning approach (student-centered learning) Deductive learning method Strategy Lectures, discussions, presentations 3 X 50			0%
2	Utilizing science and technology to search for data and information about atomic structures and as a tool to communicate the results of the search. Understand the concept of atomic structure based on Dalton and Thomson's atomic theory to analyze the weaknesses and strengths of the concept of atomic structure based on Dalton and Thomson's atomic theory. Able to make strategic decisions based on data and information to solve problems in learning about atomic structures. Responsible for self-learning, assignments, and agreements with colleagues.	1. Describe the concept of atoms according to Rutherford. 2. Describes Rutherford's experiments on the scattering of alpha particles. 3. Analyze the weaknesses and strengths of Rutherford's Atomic Theory. 4. Applying Rutherford's Scattering Formula.	**Criteria:** 1. 4: correct description 2. 3: the description is generally correct, there is one aspect where the explanation is incorrect 3. 2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4. 1: the description is wrong	Student-centered learning approach (student-centered learning) Deductive learning method Strategy Lectures, discussions, presentations 3 X 50			0%

3	Utilizing science and technology to search for data and information about atomic structures and as a tool to communicate the results of the search. Understand the concept of atomic structure based on Dalton and Thomson's atomic theory to analyze the weaknesses and strengths of the concept of atomic structure based on Dalton and Thomson's atomic theory. Able to make strategic decisions based on data and information to solve problems in learning about atomic structures. Responsible for self-learning, assignments, and agreements with colleagues.	1. Explain Bohr's postulates for the atomic concept. 2. Describe the atomic model according to Bohr. 3. Describe energy levels and spectrum according to Bohr. 4. Applying the Hydrogen Spectrum Series equation. 5. Explain the principle of atomic excitation. 6. Analyze the weaknesses and strengths of Bohr's Atomic Theory.	**Criteria:** 1. 4: correct description 2. 3: the description is generally correct, there is one aspect where the explanation is incorrect 3. 2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4. 1: the description is wrong	Student-centered learning approach (student-centered learning) Deductive learning method Strategy Lectures, discussions, presentations 3 X 50			0%
4	Utilizing science and technology to search for data and information about atomic structures and as a tool to communicate the results of the search. Understand the concept of atomic structure based on Dalton and Thomson's atomic theory to analyze the weaknesses and strengths of the concept of atomic structure based on Dalton and Thomson's atomic theory. Able to make strategic decisions based on data and information to solve problems in learning about atomic structures. Responsible for self-learning, assignments, and agreements with colleagues.	1. Describe the atomic model according to Modern Atomic Theory. 2. Explain quantum numbers. 3. Analyze the weaknesses and strengths of Modern Atomic Theory. 4. Describe atomic orbitals according to modern Atomic Theory.	**Criteria:** 1. 4: correct description 2. 3: the description is generally correct, there is one aspect where the explanation is incorrect 3. 2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4. 1: the description is wrong	Student-centered learning approach (student-centered learning) Deductive learning method Strategy Lectures, discussions, presentations 3 X 50			0%
5	Utilizing science and technology to search for data and information about radioactivity as well as a tool for communication. search results. Analyzing radioactivity symptoms based on data and/information. Able to make strategic decisions based on data and information to solve problems in learning about radioactivity.	1. Explain radioactivity based on its characteristic symptoms. 2. Analyze the relationship between the properties of the components that make up the atomic nucleus and radioactivity.	**Criteria:** 1. 4: correct description 2. 3: the description is generally correct, there is one aspect where the explanation is incorrect 3. 2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4. 1: the description is wrong	Student-centered learning approach (student-centered learning) Deductive learning method Strategy Lectures, discussions, presentations 3 X 50			0%

6	Utilizing science and technology to search for data and information about radioactivity as well as a tool for communication. search results. Analyzing radioactivity symptoms based on data and/information. Able to make strategic decisions based on data and information to solve problems in learning about radioactivity.	1. Explain radioactivity based on its characteristic symptoms. 2. Analyze the relationship between the properties of the components that make up the atomic nucleus and radioactivity.	**Criteria:** 1. 4: correct description 2. 3: the description is generally correct, there is one aspect where the explanation is incorrect 3. 2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4. 1: the description is wrong	Student-centered learning approach (student-centered learning) Deductive learning method Strategy Lectures, discussions, presentations 3 X 50			0%
7	Utilizing science and technology to search for data and information about radioactivity as well as a tool for communication. search results. Analyzing radioactivity symptoms based on data and/information. Able to make strategic decisions based on data and information to solve problems in learning about radioactivity.	1. Explain radioactivity based on its characteristic symptoms. 2. Analyze the relationship between the properties of the components that make up the atomic nucleus and radioactivity.	**Criteria:** 1. 4: correct description 2. 3: the description is generally correct, there is one aspect where the explanation is incorrect 3. 2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4. 1: the description is wrong	Student-centered learning approach (student-centered learning) Deductive learning method Strategy Lectures, discussions, presentations 3 X 50			0%
8	End of meeting ability 1 to 7	Meeting indicators 1 to 7	**Criteria:** 1. 4: correct description 2. 3: the description is generally correct, there is one aspect where the explanation is incorrect 3. 2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4. 1: the description is wrong	UTS 3 X 50			0%

9	Utilizing science and technology to search for data and information about radioactivity as well as a tool for communication. search results. Analyzing radioactivity symptoms based on data and/information. Able to make strategic decisions based on data and information to solve problems in learning about radioactivity.	1. Analyze the properties of radioactive rays based on their interactions with observable materials. 2. Explain the use of radioactive rays.	**Criteria:** 1. 4: correct description 2. 3: the description is generally correct, there is one aspect where the explanation is incorrect 3. 2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4. 1: the description is wrong	Student-centered learning approach (student-centered learning) Deductive learning method Strategy Lectures, discussions, presentations 3 X 50			0%
10	Utilizing science and technology to search for data and information about radioactivity as well as a tool for communication. search results. Analyzing radioactivity symptoms based on data and/information. Able to make strategic decisions based on data and information to solve problems in learning about radioactivity.	1. Analyze the properties of radioactive rays based on their interactions with observable materials. 2. Explain the use of radioactive rays.	**Criteria:** 1. 4: correct description 2. 3: the description is generally correct, there is one aspect where the explanation is incorrect 3. 2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4. 1: the description is wrong	Student-centered learning approach (student-centered learning) Deductive learning method Strategy Lectures, discussions, presentations 3 X 50			0%
11	Utilizing science and technology to search for data and information about radioactivity as well as a tool for communication. search results. Analyzing radioactivity symptoms based on data and/information. Responsible for self-learning, assignments and agreements with colleagues. Able to make strategic decisions based on data and information to solve problems in learning about radioactivity.	Analyze mathematical models of radioactive decay	**Criteria:** 1. 4: correct description 2. 3: the description is generally correct, there is one aspect where the explanation is incorrect 3. 2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4. 1: the description is wrong	Student-centered learning approach (student-centered learning) Deductive learning method Strategy Lectures, discussions, presentations 3 X 50			0%

12	Utilizing science and technology to search for data and information about radioactivity as well as a tool for communication. search results. Analyzing radioactivity symptoms based on data and/information. Responsible for self-learning, assignments and agreements with colleagues. Able to make strategic decisions based on data and information to solve problems in learning about radioactivity.	Analyze mathematical models of radioactive decay	**Criteria:** 1.4: correct description 2.3: the description is generally correct, there is one aspect where the explanation is incorrect 3.2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4.1: the description is wrong	Student-centered learning approach (student-centered learning) Deductive learning method Strategy Lectures, discussions, presentations 3 X 50			0%
13	Utilizing science and technology to search for data and information about radioactivity as well as a tool for communication. search results. Analyzing radioactivity symptoms based on data and/information. Able to make strategic decisions based on data and information to solve problems in learning about radioactivity.	1.Analyze the energy produced or required in a core reaction. 2.Explain the basic reactions that occur in nature. 3.Explain the construction of nuclear power plants.	**Criteria:** 1.4: correct description 2.3: the description is generally correct, there is one aspect where the explanation is incorrect 3.2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4.1: the description is wrong	Student-centered learning approach (student-centered learning) Deductive learning method Strategy Lectures, discussions, presentations 3 X 50			0%
14	Utilizing science and technology to search for data and information about radioactivity as well as a tool for communication. search results. Analyzing radioactivity symptoms based on data and/information. Able to make strategic decisions based on data and information to solve problems in learning about radioactivity.	1.Analyze the energy produced or required in a core reaction. 2.Explain the basic reactions that occur in nature. 3.Explain the construction of nuclear power plants.	**Criteria:** 1.4: correct description 2.3: the description is generally correct, there is one aspect where the explanation is incorrect 3.2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4.1: the description is wrong	Student-centered learning approach (student-centered learning) Deductive learning method Strategy Lectures, discussions, presentations 3 X 50			0%

15	Utilizing science and technology to search for data and information about radioactivity as well as a tool for communication. search results. Analyzing radioactivity symptoms based on data and/information. Able to make strategic decisions based on data and information to solve problems in learning about radioactivity.	1. Analyze the energy produced or required in a core reaction. 2. Explain the basic reactions that occur in nature. 3. Explain the construction of nuclear power plants.	**Criteria:** 1. 4: correct description 2. 3: the description is generally correct, there is one aspect where the explanation is incorrect 3. 2: the description is generally correct, there is more than one aspect where the explanation is incorrect 4. 1: the description is wrong	Student-centered learning approach (student-centered learning) Deductive learning method Strategy Lectures, discussions, presentations 3 X 50			0%
16							0%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
		0%

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.