

PORTFOLIO

Elemental Chemistry

ACADEMIC YEAR 2022/2023 EVEN SEMESTER



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CHEMISTRY DEPARTMENT
FACULTY OF MATHEMATICS AND NATURAL SCIENCE
UNIVERSITAS NEGERI SURABAYA

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A. SEMESTER LEARNING ACTIYITY PLAN

A.1. COURSE IDENTITY

Module Name	Elemental Chemistry
Module level	Bachelor
Abbreviation, if applicable	-
Sub-heading, if applicable	-
Course included in the module, if applicable	-
Semester/term	4 th /Second Year
Module coordinator(s)	Prof. Dr. Achmad Lutfi, M.Pd.
Lecturer(s)	Prof. Dr. Achmad Lutfi, M.Pd. Dr. Kusumawati Dwiningsih, S.Pd. M.Pd. Amalia Putri Purnamasari, S.Si., M.Si. Dr. Muchlis, S.Pd., M.Pd.
Language	Indonesian
Classification within the curriculum	Compulsory Course
Teaching format/class hours per week during the semester:	3 hours lecturers (50 min per hours)
Workload:	1 CU for bachelor degree equals to 3 workhours per week or 170 minutes (50' face to face learning, 60' structured learning, and 60' independent learning). In one semester, courses are conducted in 14 weeks (excluding mid and end-term exam). Thus, 1 CU equals to 39.67 workhours per semester. One CU equals to 1.587 ECTS.
Credit points:	3 CU (4,761 ECTS)
Prerequisites course(s):	-
Targeted learning outcomes:	<ol style="list-style-type: none">1. Develop logical, critical, systematic and creative thinking in carrying out specific work in the field of expertise and in accordance with the work competency standards in the relevant field.2. Able to demonstrate knowledge related to theoretical concepts of structure, dynamics and energy, as well as the basic principles of separation, analysis, synthesis and characterization of chemicals.3. Mastering the principles of K3 (Occupational Safety and Security), managing laboratories, and using equipment as well as how to operate chemical instruments.4. Mastering the basics of scientific methods, designing and implementing research, compiling scientific

	reports and communicating them both orally and in writing by utilizing information and communication technology in the field of education.
Content:	<ol style="list-style-type: none"> 1. Introduction to elemental chemistry and periodic trends 2. Abundance and distribution of elements in nature 3. Properties and reactivity of main group elements (IA–VIIIA) 4. Hydrogen: characteristics and applications 5. Properties and uses of Groups IA and IIA elements 6. Properties and uses of Groups IIIA–VIIA elements 7. Noble gases: characteristics and utilization 8. General characteristics and periodicity of transition metals 9. Properties and applications of transition metal groups (3–12) 10. Industrial applications and field study on elemental chemistry
Study / exam achievements:	<p>Students are considered to be competent and pass if at least get 55.</p> <p>Final score is calculated as follows: 20% participation + 30% assignment + 20% middle exam (UTS) & 30% final exam (UAS)</p> <p>Table index of graduation:</p> <ul style="list-style-type: none"> ● A = 4 (85 ≤ - < 100) ● A- = 3,75 (80 ≤ - < 85) ● B+ = 3,5 (75 ≤ - < 80) ● B = 3 (70 ≤ - < 75) ● B- = 2,75 (65 ≤ - < 75) ● C+ = 2,5 (60 ≤ - < 65) ● C = 2 (55 ≤ - < 60) ● D = 1 (40 ≤ - < 55) ● E = 0 (0 ≤ - < 40)
Media:	Computer, LCD, White board
Learning Methods	Individuals assignment, group assignment, discussion, presentation, and practicum
Literature:	<ol style="list-style-type: none"> 1. Lee, J.D. 1991. Concise Inorganic Chemistry . Four Edition. London: Chapman & Hall. 2. Madan, R.D. 1997. Modern Inorganic Chemistry . NewDelhi: S. Chand and Company LDT. 3. Sugiarto, B. dkk. 1997. Kimia Anorganik . Surabaya: Unipress IKIP Surabaya. 4. Perry, Dale L. 2011. Handbook of Inorganic Compounds,

	<p>Second Edition (Hardcover) – May 2011. ISBN-13: 000-1439814619 ISBN- 10: 14398146</p> <p>5. Jurnal ilmiah</p>
<p>Note</p>	<ol style="list-style-type: none"> 1. Learning Outcomes of Study Program Graduates are abilities possessed by each Study Program graduate which is an internalization of attitude, mastery of knowledge and skills according to the level of study program obtained through the learning process. 2. Learning Outcomes of Study Program Graduates assigned to courses are some of the learning outcomes of study program graduates used for the formation/development of a course consisting of aspects of attitude, general skills, specific skills and knowledge. 3. Course Learning Outcomes are abilities that are specifically described from Study Program Graduate Learning Outcomes that are assigned to courses, and are specific to the study material or learning material for that course. 4. Subject Learning Outcomes are abilities that are specifically described from Course Learning Outcomes that can be measured or observed and are the final abilities that are planned at each stage of learning, and are specific to the course learning material. 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 that are used as a measure or benchmark of learning achievement in assessment based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be either quantitative or qualitative.

A.2. COURSE TOPIC

Study of the abundance, properties, methods of obtaining, benefits, and methods of identifying elements and their compounds from the main and transition groups (first, second, and third series block d). Learning is carried out through discussions, presentations, practicums, and project assignments, so that students are able to think critically and creatively, understand theoretical

concepts, apply K3 principles and the use of laboratory instruments, and convey ideas orally and in writing using information technology.

A.3. COURSE PROGRAM

		UNIVERSITAS NEGERI SURABAYA FACULTY OF MATHEMATICS AND NATURAL SCIENCE UNDERGRADUATE PROGRAMME OF CHEMISTRY EDUCATION				Document Code		
		SEMESTER LEARNING ACTIIVITY PLAN						
COURSE		Code	Course Group		Credit Unit		Semester	Date
Elemental Chemistry		8420403325			T= 3	P= 0	4	August, 18 2025
AUTHORIZATION CHEMISTRY EDUCATION		Compiler		Coordinator		Head of Study Program		
		Dr. Kusumawati Dwiningsih, S.Pd. M.Pd		Prof. Dr. Achmad Lutfi, M.Pd.		Prof. Dr. Utiya Azizah, M.Pd		
Learning Outcomes	Program Learning Outcomes (PLO)							
	PLO3 (GS-2)	Develop logical, critical, systematic and creative thinking in carrying out specific work in the field of expertise and in accordance with the work competency standards in the relevant field.						
	PLO6 (KN-1)	Able to demonstrate knowledge related to theoretical concepts of structure, dynamics and energy, as well as the basic principles of separation, analysis, synthesis and characterization of chemicals.						
	PLO8 (KN-3)	Mastering the principles of K3 (Occupational Safety and Security), managing laboratories, and using equipment as well as how to operate chemical instruments.						
	PLO11 (SS-2)	Mastering the basics of scientific methods, designing and implementing research, compiling scientific reports and communicating them both orally and in writing by utilizing information and communication technology in the field of education.						
	Course Learning Outcomes (CLO)							
	CLO1	Students are able to analyze the abundance, properties, benefits, and periodic trends of main and transition group elements logically, critically, systematically, and creatively through discussions, case studies, and class presentations with coherent arguments and supported by relevant scientific sources. PLO-3						
CLO2	Students are able to analyze theoretical concepts regarding atomic structure, reaction dynamics, bond energy, as well as basic principles of analysis, synthesis, and characterization of main and transition group elements based on literature and results of practical observations with a minimum accuracy of 75% according to the							

		assessment criteria. PLO-6
	CLO3	Students are able to apply K3 principles, operate laboratory equipment, and carry out practical work on the identification and utilization of elements and compounds appropriately during practical activities by consistently complying with safety procedures and without fatal errors. PLO-8
	CLO4	Students are able to design and carry out mini research, compile scientific reports, and communicate the results of studies and practical work orally and in writing by utilizing information technology through project assignments and final presentations with a minimum quality of the "Good" category according to the assessment rubric. PLO-11
	CLO5	Analyze the application of the concept of elemental chemistry in industrial processes through field visits and compile systematic reports on observation results. PLO-11
Brief Description of the Course	Study of the abundance, properties, methods of obtaining, benefits, and methods of identifying elements and their compounds from the main and transition groups (first, second, and third series block d). Learning is carried out through discussions, presentations, practicums, and project assignments, so that students are able to think critically and creatively, understand theoretical concepts, apply K3 principles and the use of laboratory instruments, and convey ideas orally and in writing using information technology.	
Study Materials: Learning Materials	<ol style="list-style-type: none"> 1. Introduction to elemental chemistry and periodic trends 2. Abundance and distribution of elements in nature 3. Properties and reactivity of main group elements (IA–VIII A) 4. Hydrogen: characteristics and applications 5. Properties and uses of Groups IA and IIA elements 6. Properties and uses of Groups IIIA–VIIA elements 7. Noble gases: characteristics and utilization 8. General characteristics and periodicity of transition metals 9. Properties and applications of transition metal groups (3–12) 10. Industrial applications and field study on elemental chemistry 	
Reference	Main:	
	<ol style="list-style-type: none"> 1. Lee, J.D. 1991. Concise Inorganic Chemistry . Four Edition. London: Chapman & Hall. 2. Madan, R.D. 1997. Modern Inorganic Chemistry . NewDelhi: S. Chand and Company LDT. 	

	<p>3. Sugiarto, B. dkk. 1997. Kimia Anorganik . Surabaya: Unipress IKIP Surabaya.</p> <p>4. Perry, Dale L. 2011. Handbook of Inorganic Compounds, Second Edition (Hardcover) – May 2011. ISBN-13: 000-1439814619 ISBN- 10: 14398146</p> <p>5. Jurnal ilmiah</p> <p>Additional:</p>						
Lecturer	<p>Prof. Dr. Achmad Lutfi, M.Pd. Dr. Kusumawati Dwiningsih, S.Pd. M.Pd. Amalia Putri Purnamasari, S.Si., M.Si. Dr. Muchlis, S.Pd., M.Pd.</p>						
Prerequisite courses							
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	Analyze the scope of elemental chemistry and its relationship to the periodic properties, abundance, and utilization of elements, and specifically examine the properties and uses of the element Hydrogen.	1. Students are able to analyze the relationship between the scope of the study of elemental chemistry and the concept of periodic properties using periodic table data, with a minimum	<p>Assessment criteria: Academic ethics and attitudes (polite, respecting opinions, following class rules)</p> <p>Assessment form : Participatory Activities</p>	Interactive lectures, class discussions 3 X 50	e-learning	<p>Learning materials: Introduction to Elemental Chemistry</p> <p>Bibliography: <i>Lee, J.D. 1991. Concise Inorganic Chemistry . Four Edition. London:</i></p>	5

		<p>accuracy of 75%</p> <p>2. Students are</p> <p>3. able to analyze the relationship between the periodic properties of elements and their abundance levels in nature and explain their uses in everyday life and industry logically.</p> <p>4. Students are able to describe and study the special properties and uses of the element Hydrogen based on literature or practical results with systematic arguments.</p>				<i>Chapman & Hall.</i>	
2	Analyze the physical and chemical properties, abundance, and methods of obtaining group IA and IIA elements based on periodic trends and	1. Students are able to analyze the physical and chemical properties of group IA–IIA	Assessment criteria: Academic Ethics & Attitude – polite, respecting	Discussion, Q&A and presentation 3 X 50	discussion forum	Learning materials: Properties, Abundance, and How to Obtain Group	5

	<p>their applications in life and industry.</p>	<p>elements based on periodic data and literature with a minimum accuracy of 75%.</p> <p>2. Students are able to analyze the relationship between the periodic properties of group IA–IIA elements and their abundance levels in nature in a logical and systematic manner.</p> <p>3. Students are able to analyze how to obtain group IA–IIA elements from natural materials through literature reviews or simple case studies by stating the appropriate method.</p>	<p>other people's opinions, disciplined in following class rules.</p> <p>Assessment form : Participatory Activities</p>			<p>IA–IIA Elements</p> <p>Bibliography: <i>Lee, J.D. 1991. Concise Inorganic Chemistry . Four Edition. London: Chapman & Hall.</i></p>	
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3	Analyze the physical and chemical properties, abundance, and methods of obtaining group IA and IIA elements based on periodic trends and their applications in life and industry.	<p>4. Students are able to analyze the physical and chemical properties of group IA–IIA elements based on periodic data and literature with a minimum accuracy of 75%.</p> <p>5. Students are able to analyze the relationship between the periodic properties of group IA–IIA elements and their abundance levels in nature in a logical and systematic manner.</p> <p>Students are able to analyze how to obtain group IA–IIA elements from natural materials through literature reviews or simple case studies by</p>	<p>Assessment criteria: Academic Ethics & Attitude – polite, respecting other people's opinions, disciplined in following class rules.</p> <p>Assessment form : Participatory Activities</p>	Discussion, Q&A and presentation 3 X 50	discussion forum	<p>Learning materials: Properties, Abundance, and How to Obtain Group IA–IIA Elements</p> <p>Bibliography: <i>Lee, J.D.</i> <i>1991. Concise Inorganic Chemistry .</i></p> <p>1. <i>Four Edition.</i> <i>London: Chapman & Hall.</i></p>	5
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		stating the appropriate method.					
4	Analyze the properties, abundance, and uses of group VA–VIIA elements based on periodic trends and their applications in life and industry.	<ol style="list-style-type: none"> Students are able to analyze the physical and chemical properties of group VA–VIIA elements based on periodic trends (ionization energy, electronegativity, atomic radius, oxidation number). Students are able to connect the properties of group VA–VIIA elements with their abundance and important compounds in daily life and industry. Students are able to evaluate the utilization and environmental 	<p>Assessment criteria: Accuracy of Property Analysis – able to describe the physical and chemical properties of elements class VA–VIIA according to periodic data.</p> <p>▪ Assessment form : Participatory Activities</p>	Class discussion, article analysis 3 X 50	LMS	<p>Learning materials: Characteristics and Utilization of Group VA–VIIA Elements</p> <p>Bibliography:</p> <ol style="list-style-type: none"> <i>Madan, R.D. 1997. Modern Inorganic Chemistry . New Delhi: S. Chand and Company LDT.</i> 	5

		impact of the use of the main compounds of groups VA–VIIA through literature studies or simple cases.					
5	Evaluate the physical and chemical properties, abundance, and uses of noble gases (group VIIIA) by connecting their periodic characteristics and applications in life and industry.	<ol style="list-style-type: none"> 1. Students are able to analyze the physical and chemical properties of noble gases (He, Ne, Ar, Kr, Xe, Rn) based on periodic data and literature with a minimum accuracy of 75%. 2. Students are able to evaluate the relationship between the unique properties of noble gases (inertial, low boiling point, monatomic) and their uses in industry, health, and technology. 	<p>Assessment criteria: Relevance of utilization evaluation (advantages, limitations, impacts) to real applications.</p> <p>Assessment form : Participatory Activities</p>	Interactive lectures and discussions 3 X 50	online quiz	<p>Learning materials: Properties and Uses of Group VIIIA Elements (Noble Gases)</p> <p>Bibliography: <i>Lee, J.D. 1991. Concise Inorganic Chemistry . Four Edition. London: Chapman & Hall.</i></p>	5

		3. Students are able to assess the advantages and limitations of using noble gases in certain applications (e.g. He for refrigerants, Ne for lamps, Xe for anesthesia) logically and systematically.					
6	Analyze the important concepts of main group elements based on periodic properties, abundance, and their uses in life and industry.	<ol style="list-style-type: none"> 1. Students are able to apply the concept of periodic properties to group main group elements according to group and period with a minimum accuracy of 75%. 2. Students are able to analyze the relationship between the physical and chemical properties of main 	<p>Assessment criteria: The ability to systematically compare trait trends across major groups.</p> <p>Assessment form : Test</p>	Written test 150 menit	CBT 0	<p>Learning materials: Concept, Properties, Abundance, and Utilization of Main Group Elements (IA–VIIIA)</p> <p>Bibliography: <i>Perry, Dale L. 2011. Handbook of Inorganic Compounds, Second Edition</i></p>	8

		<p>group elements and their periodic trends logically and systematically.</p> <p>3. Students are able to analyze the relationship between the periodic properties of elements and their abundance levels in nature.</p> <p>4. Students are able to evaluate the use of main group elements in daily life and industry based on their properties.</p> <p>5. Students are able to compare the characteristics between the main groups (IA–VIIIA) and conclude the differences in trends in properties and</p>				<p><i>(Hardcover) – May 18, 2011. ISBN-13: 000- 1439814619 ISBN-10: 14398146</i></p>	
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		their uses.					
7	Analyze the general characteristics of transition elements including variations in oxidation numbers, complex formation, catalytic properties, and the tendency for colored ions.	<ol style="list-style-type: none"> 1. Students are able to analyze variations in the oxidation numbers of transition elements based on the electron configuration and stability of the compounds formed. 2. Students are able to analyze the formation of complexes and their relationship to the catalytic properties of transition elements through industrial or laboratory case examples. 3. Students are able to analyze the tendency of colored ions in complex compounds of 	<p>Assessment criteria: Academic Attitude – discipline, respect for opinions, and ethics in discussions/presentations.</p> <p>Assessment form : Participatory Activities</p>	Interactive lectures and discussions 150 minit	LMS	<p>Learning materials: General Characteristics of Transition Elements: Oxidation Numbers, Complexes, Catalytic Properties, and Ion Colors</p> <p>Bibliography: <i>Madan, R.D. 1997. Modern Inorganic Chemistry . New Delhi: S. Chand and Company LTD.</i></p>	5

		transition elements by connecting ligand field theory and experimental data.					
8	Analyzing the properties, abundance, and utilization of transition elements of groups 3, 4, and 5 (Sc, Ti, V, Nb, Ta)	<ol style="list-style-type: none"> 1. Students are able to analyze the physical and chemical properties of the elements Sc, Ti, V, Nb, and Ta based on their electron configuration, oxidation number, and periodic trends. 2. Students are able to connect the properties of elements in groups 3, 4, and 5 with the abundance of minerals in nature through relevant literature. 3. Students are able 	<p>Assessment criteria: Academic Ethics & Attitude – being polite, respecting others' opinions, and following class rules.</p> <p>Assessment form : Participatory Activities</p>	Case studies, group discussions 3x50'		<p>Learning materials: Transition Elements of Groups 3, 4, and 5 (Sc, Ti, V, Nb, Ta): Properties, Abundance, and Uses</p> <p>Bibliography: <i>Lee, J.D. 1991. Concise Inorganic Chemistry . Four Edition. London: Chapman & Hall.</i></p>	5

		to evaluate the strategic use of Sc, Ti, V, Nb, and Ta elements in the industrial sector (aerospace, catalysts, superconductors, electronics) with logical arguments.					
9	Applying the principles of K3 in conducting experiments to analyze the physical and chemical properties of the element Hydrogen and its reactivity with various substances.	<ol style="list-style-type: none"> 1. Students are able to use tools, materials, and procedures according to work safety principles during practicals. 2. Students are able to carry out the steps of the hydrogen experiment systematically, carefully, and according to instructions. 3. Students are able to analyze the results of 	<p>Assessment criteria: Completeness and accuracy of experimental data analysis and conformity with theory.</p> <p>Assessment form : Practical Assessment</p>	Offline practicum 3x50'	online discussion	<p>Learning materials: Lab: Properties and Reactions of Hydrogen</p> <p>Bibliography: <i>Sugiarto, B. dkk. 1997. Kimia Anorganik . Surabaya: Unipress IKIP Surabaya.</i></p>	7

		hydrogen reactions with various substances logically and support them with observational data.					
10	Analyze the results of ligand field experiments to explain the relationship between ligand types and color differences in transition metal ion complexes based on ligand field theory.	<ol style="list-style-type: none"> 1. Students are able to carry out ligand field experiments according to practical procedures and K3 principles. 2. Students are able to analyze experimental data (color of transition metal ion complexes with various ligands). 3. Students are able to connect the results of the experiment with ligand field theory to explain the observed 	<p>Assessment criteria: The accuracy of the analysis of the relationship between ligand types, complex color differences, and the concept of ligand field theory.</p> <p>Assessment form : Practical Assessment</p>	Practicum, discussion of results 3x50'	LMS	<p>Learning materials: Metal extraction, physical and chemical properties of elements and compounds of scandium and titanium.</p> <p>Bibliography: <i>Madan, R.D. 1997. Modern Inorganic Chemistry . New Delhi: S. Chand and Company LDT.</i></p> <p>Learning</p>	7

		color differences.				materials: Ligand Field Lab and Transition Ion Complex Color Bibliography: <i>Madan, R.D.</i> 1997. <i>Modern Inorganic Chemistry . New Delhi: S. Chand and Company LDT.</i>	
11	Analyze the results of transition metal reactions to identify changes in oxidation numbers and their relationship to the stability of compounds and the typical properties of transition metals.	1. Students are able to carry out transition metal reaction experiments according to practical procedures and K3 principles. 2. Students are able to analyze experimental data to identify changes in the oxidation number of transition metals. 3. Students are able	Assessment criteria: The accuracy of the analysis of changes in oxidation numbers and their relationship to the stability of compounds. ▪ Assessm ent form : Practical Assessment	Practicum 3x50'	LMS	Learning materials: Transition Metal Reactions and Oxidation Number Changes Lab Bibliography: <i>Lee, J.D.</i> 1991. <i>Concise Inorganic Chemistry . Four Edition. London: Chapman & Hall.</i>	7

		to connect the results of experiments with the concept of compound stability and the typical properties of transition metals.					
12	Analyze the physical, chemical, abundance, and utilization properties of transition elements of group 6 (Chromium/Cr, Molybdenum/Mo, Tungsten/W) and group 7 (Manganese/Mn, Technetium/Tc, Rhenium/Re) based on periodic trends and their applications in industry.	<ol style="list-style-type: none"> 1. Students are able to analyze the physical and chemical properties of the elements Cr, Mo, W, Mn, Tc, and Re based on periodic trends and electron configurations. 2. Students are able to relate the properties of group 6 and 7 elements to their abundance and mineral origin in nature using literature data 3. Students are able 	<p>Assessment criteria: Academic Attitude – showing politeness, respecting opinions, working together in groups, and being disciplined in following class rules.</p> <p>Assessment form : Participatory Activities</p>	Discussion, literature review 3x50'		<p>Learning materials: Transition Elements of Groups 6 and 7: Properties, Abundance, and Uses</p> <p>Bibliography: <i>Lee, J.D. 1991. Concise Inorganic Chemistry . Four Edition. London: Chapman & Hall.</i></p>	5

		to evaluate the strategic use of group 6 and 7 elements (e.g. stainless steel, industrial catalysts, superalloys, radioisotopes) with logical and critical arguments.					
13	Analyze the physical and chemical properties, abundance, and utilization of transition elements in groups 8– 12 (Fe, Co, Ni, Cu, Zn) based on periodic trends and their applications in life and industry.	<ol style="list-style-type: none"> Students are able to analyze the physical and chemical properties of the elements Fe, Co, Ni, Cu, and Zn based on electron configuration and periodic trends. Students are able to connect properties with the abundance and mineral origin of the elements Fe, Co, Ni, Cu, and Zn in nature through 	<p>Assessment criteria: Academic Attitude – demonstrates academic ethics: polite, disciplined, and respects the opinions of others in discussions/presentations.</p> <p>▪ Assessment form : Participatory Activities</p>	Discussion, presentation 3x50'	Forum discussions in LMS	<p>Learning materials: Group 8–12 Transition Elements: Fe, Co, Ni, Cu, Zn</p> <p>Bibliography: <i>Madan, R.D. 1997. Modern Inorganic Chemistry . New Delhi: S. Chand and Company LDT.</i></p>	5

		<p>literature studies.</p> <p>3. Students are able to evaluate the strategic use of the elements Fe, Co, Ni, Cu, and Zn in the industrial sector (steel, superalloys, metal plating, electrical conductors, galvanization) logically and critically.</p>					
14	Analyze the properties, abundance, and uses of transition elements in groups 6–12 based on periodic trends and their applications in life and industry.	<p>1. Students are able to analyze the physical and chemical properties of transition elements in groups 6–12 based on electron configuration and periodic trends</p> <p>2. Students are able to connect the properties of transition</p>	<p>Assessment criteria: Comparative Ability – the ability to systematically distinguish trends in properties and uses between groups (6–12).</p> <p>Assessment form : Test</p>	Written test 3x50'	CBT	<p>Learning materials: Transition Elements Groups 6–12: Properties, Abundance, and Uses</p> <p>Bibliography: <i>Lee, J.D. 1991. Concise Inorganic Chemistry .</i></p> <p>1. <i>Four Edition.</i></p>	8

		<p>elements in groups 6–12 with their abundance and the minerals they come from in nature.</p> <p>3. Students are able to evaluate the strategic use of transition elements of groups 6–12 in the industrial sector (steel, metal alloys, catalysts, electronics, energy).</p> <p>4. Students are able to compare trends in properties and uses between groups (6–12) systematically and critically.</p> <p>5. Students are able to present scientific arguments in a coherent, logical, and literature-</p>				<p><i>London: Chapman & Hall.</i></p>	
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		based manner in discussions or presentations related to the properties and uses of transition elements in groups 6–12.					
15	Analyze the application of the concept of elemental chemistry in industrial processes through systematic and responsible field observation activities.	<ol style="list-style-type: none"> 1. Students are able to identify the application of chemical element concepts that are relevant to industrial processes during the visit. 2. Students are able to analyze the results of field observations and relate them to lecture material logically and systematically 3. Students are able to compile industrial visit reports with a responsible, 	<p>Assessment criteria: Report Preparation & Academic Attitude – students' ability to prepare visit reports systematically by demonstrating good discipline, responsibility, and academic ethics.</p> <p>Assessment form : Participatory Activities, Portfolio Assessment</p>	Field/Industrial visits 3x50'	reflective discussion	<p>Learning materials: Industrial Visit: Application of Elemental Chemistry Concepts in the Industrial World Bibliography: <i>Perry, Dale L. 2011. Handbook of Inorganic Compounds, Second Edition (Hardcover) – May 18, 2011. ISBN-13: 000-1439814619</i> 1. <i>ISBN-10: 14398146</i></p>	9

		disciplined attitude and respect for academic ethics.					
	Presenting the results of industrial visit analysis orally and in writing systematically, logically, and upholding academic ethics.	<ol style="list-style-type: none"> 1. Students are able to compile reports on the results of industrial visits in a coherent, systematic and scientific manner. 2. Students are able to present the results of the analysis orally (presentation) using clear, logical language, supported by observation data. 3. Students are able to demonstrate academic ethics in presentations (discipline, teamwork, respect for the audience, politeness). 	<p>Assessment criteria: Academic attitude in presentation (discipline, polite, respect for opinions).</p> <p>Assessment form : Participatory Activities, Project Result Assessment / Product Assessment, Portfolio Assessment</p>	Presentations and reports 3x50'	LMS	<p>Learning materials: Industrial Visit Report & Presentation</p> <p>Bibliography: <i>Perry, Dale L. 2011. Handbook of Inorganic Compounds, Second Edition (Hardcover) – May 18, 2011. ISBN-13: 000-1439814619 ISBN-10: 14398146</i></p>	9

A.4. MAPPING OF LEARNING OUTCOMES – COURSE OUTCOMES

A.4.1. The Expected Program Learning Outcomes (PLO) of Undergraduate Program of Education Chemistry (UPCE)

Competency SSC-ASIIN	Aspect	PLO	DESCRIPTION
Social competences	Attitudes 1 (AT-1)	PLO 1	Demonstrates religious, national, and cultural values, as well as academic ethics, in carrying out their duties
	Attitudes 2 (AT-2)	PLO 2	Demonstrates a resilient, collaborative, adaptive, innovative, inclusive, lifelong learning, and entrepreneurial character
	General Skills 1 (GS-1)	PLO 3	Develops logical, critical, systematic, and creative thinking in carrying out specific work in the field of expertise and in accordance with the work competency standards in the relevant field.
	General Skills 2 (GS-2)	PLO 4	Develops self-sustainably and collaborates.
	General Skills 3 (GS-3)	PLO 5	Makes decisions based on data/information to complete tasks that are their responsibility and evaluate the performance carried out both individually and in groups, and have an environmentally conscious edu-ecopreneurship spirit.
Specialist competences	Knowledge 1 (KN-1)	PLO 6	Demonstrates knowledge related to theoretical concepts of structure, dynamics, and energy, as well as the basic principles of separation, analysis, synthesis, and characterization of chemicals
	Knowledge 2 (KN-2)	PLO 7	Demonstrates pedagogical knowledge of chemistry and applies it in designing, implementing, and evaluating learning.
	Knowledge 3 (KN-3)	PLO 8	Masters laboratory management based on the principles of Occupational Safety and Security (K3), managing the laboratory and using its equipment, and how to operate chemical instruments
	Knowledge 4 (KN-4)	PLO 9	Design, implement, evaluate learning, and develop chemistry learning media by utilizing Information and Communication Technology.
	Special Skills 1 (SS-1)	PLO 10	Develops or implements science, technology, and art that pay attention to and apply humanities values that are appropriate to the field of chemistry education in solving problems.
	Special Skills 2 (SS-2)	PLO 11	Masters the basics of scientific methods, designing and implementing research, compiling

Competency SSC-ASIIN	Aspect	PLO	DESCRIPTION
			scientific reports, and communicating them both orally and in writing by utilizing information and communication technology in the field of education

A4.2. The Program Education Objectives (PEOs) of Elemental Chemistry.

- PEO 1. Mastering in the concepts of chemistry, chemistry learning, laboratory management, scientific methods, and ICT, and is able to apply them to problem solving in their work.
- PEO 2. A high-level thinking ability to communicate ideas verbally and in writing, ability to take the right initiatives and decisions, and lead working groups in relevant fields.
- PEO-3 Ability to collaborate, be honest, and be responsible for work in the field of expertise and entrepreneurship in the field of education that is environmentally friendly (green-edupreneurship).
- PEO-4 Capability to continue to develop and lifelong learning to continue education, both formal and informal
- PEO-5 Ability to develop and apply chemical competencies along with advances in science and technology, and humanities values

A4.3. Mapping of Program Learning Outcomes (PLO) – Program Education Objectives (PEOs)

	PLO 3 (GS-1)	PLO 6 (KN-1)	PLO 8 (KN-3)	PLO-11 (SS-2)
PEO 1		√	√	√
PEO 2	√			√
PEO 3	√			
PEO 4	√			√
PEO 5		√	√	

B. COURSE ASSESSMENT

B.1. Assessment Rubric

Cognitive Criteria

1. The ability to explain the properties and trends of elements accurately.
2. The ability to provide argumentation based on periodic theory and elemental behavior.
3. The ability to present systematic explanations of elemental groups and their chemical characteristics.
4. The ability to analyze and solve problems related to the reactions, applications, and periodic trends of elements comprehensively.

B.2. Assessment System

Final Assessment Course	
Participation	: 20%
Assignment	: 30%
Midterm examination	: 20%
Final examination	: 30%

Distribution of the weight of the ability of the test item

	PLO 3 (GS-1)	PLO 6 (KN-1)	PLO 8 (KN-3)	PLO-11 (SS-2)	Total
Practicum	20%	30%	30%	20%	100%
Group/Individuals Assignment	20%	30%	20%	30%	100%
Midterm examination	30%	20%	20%	30%	100%
Final examination	30%	30%	20%	20%	100%

Success Criteria of Program Learning Outcomes (PLO)

Excellence	≥ 80
Good	≥ 70
Satisfy	≥ 50
Failed	< 0

Final index for undergraduate program defined as follow:

Final Index	Range
A	4 (85 \leq - \geq 100)
A ⁻	3,75 (80 \leq - $<$ 85)
B ⁺	3,5 (75 \leq - $<$ 80)
B	3 (70 \leq - $<$ 75)
B ⁻	2,75 (65 \leq - $<$ 75)
C ⁺	2,5 (60 \leq - $<$ 65)
C	2 (55 \leq - $<$ 60)
D	1 (40 \leq - $<$ 55)
E	0 (0 \leq - $<$ 40)

C. COURSE DEVELOPMENT

C.1. Academic Year 2022/2023 odd semester

Parameter	Σ of person	Percentage
Number or students taking this subject	77	100%
Number of students who pass at first attempt ($>C^+$)	77	100%
Number of students who must take remedial	0	0%
Number of failed students after remedial (D & E)	0	0%

C.2. Problems Analysis

In the 2022/2023 academic year, all students (100%) passed the Elemental Chemistry course on their first attempt. However, several challenges were observed, such as students' varying levels of understanding of periodic trends and elemental properties, and limited engagement during

group tasks. These issues indicate the need to enhance learning strategies to support deeper conceptual understanding.

C.3. Solutive Strategy

To improve learning outcomes in the next academic years, the following strategies are proposed:

1. Redesigning course materials to be more visual, interactive, and easier to understand.
2. Providing online pre-class resources to support students' readiness for new topics.
3. Strengthening analytical skills through varied learning models and structured group activities.

D. APPENDIX

D.1. DOCUMENT OF COURSE ACTIVITY

D.1.1. Lecture's journal and student's attendance form siakadu.uneca.ac.id

12/11/25, 10:31 AM

SIAKAD : Absen



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PRESENSI KULIAH
 Periode 2022/2023 Genap

Mata Kuliah : Kimia Unsur
Kelas : 2021U
Prodi : S1 Pendidikan Kimia

Dosen : Dr. Dina Kartika Maharani, S.Si., M.Sc.
 Dr. Muchlis, S.Pd., M.Pd.
 Dr. Rusly Hidayah, S.Si., M.Pd.

No	NIM	Nama Mahasiswa	Pertemuan Ke																%
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
			06 Feb 23	13 Feb 23	20 Feb 23	27 Feb 23	06 Mar 23	13 Mar 23	20 Mar 23	27 Mar 23	03 Apr 23	10 Apr 23	17 Apr 23	01 May 23	08 May 23	15 May 23	22 May 23		
1.	21030194002	REVANI PUTRI ISWAJI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
2.	21030194004	MERYNKE AYU NAVA TIANA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
3.	21030194006	LILY WIDYA SARI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
4.	21030194009	SABRINA ANGELI ALMIRA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
5.	21030194016	DHEA MUTIARA FERNANDA WIBOWO	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
6.	21030194020	KHOLFINA FITROTIS SHOBAKHAH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
7.	21030194021	ALYA AQILAH ZAHRA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
8.	21030194027	SITI ANDINI AJENG PRAMESTI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
9.	21030194028	REVANDIKA AJI HIDAYATULLOH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
10.	21030194034	RAHMANIA FITRAH SARI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
11.	21030194039	PINGKY NIRMALA PRADITA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
12.	21030194043	SALSA SABRINA FAJAR MAULIDIAH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
13.	21030194044	JIHAN SAFITRI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
14.	21030194052	AUDY VIA RAHMAWATI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
15.	21030194055	KHALIA ROSSIE	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
16.	21030194059	DIA AYU PERMATASARI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
17.	21030194060	SHAFNA NOR JANAH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
18.	21030194061	ANDINI PUTRI TANIA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
19.	21030194065	LIZA NURRAHMA DWI AGUSTIN	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
20.	21030194066	YUNITA ANGGRAENI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
21.	21030194067	BERLIANA AFSOHIN NABILA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
22.	21030194068	MAHARANI DYAH ARUMSARI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
23.	21030194076	ADINDA NURISKA RAGIL KINANTHI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
24.	21030194079	PUTRI NURJIHAN NAJLA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
Tanda Tangan Dosen / Asisten																			


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PRESENSI KULIAH
 Periode 2022/2023 Genap

Mata Kuliah : Kimia Unsur
 Kelas : 2021A
 Prodi : S1 Pendidikan Kimia

Dosen : Prof. Dr. Achmad Lutfi, M.Pd.
 Dr. Kusumawati Dwiningsih, S.Pd., M.Pd.
 Amalia Putri Purnamasari, S.Si., M.Si.

No	NIM	Nama Mahasiswa	Pertemuan Ke																%
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
			09 Feb 23	16 Feb 23	23 Feb 23	02 Mar 23	09 Mar 23	16 Mar 23	23 Mar 23	30 Mar 23	06 Apr 23	13 Apr 23	20 Apr 23	04 May 23	11 May 23	18 May 23	25 May 23		
1.	21030194001	NURIL AULIYAH SYAHIDAH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
2.	21030194003	DIVA DWI PRATIWI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
3.	21030194005	ALFINA NORMA AZIZAH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
4.	21030194007	AFRIJIA DWI ADELIANI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
5.	21030194013	FAVIAN AGUNG DIFA' SASKARA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
6.	21030194014	ALIVIA PUTRI RYNI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
7.	21030194015	ANGGK FEBRIANA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
8.	21030194017	SRI RENATA MAHARDHIKA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
9.	21030194018	FADILAH MUTIARA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
10.	21030194019	KHOLIFATUL NAIMAH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
11.	21030194023	KARINA RIKE PRATIWI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
12.	21030194024	TUTUT SUGIARTI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
13.	21030194025	RATNA DWI SETYORINI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
14.	21030194026	NILA ZULFA IZZATI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
15.	21030194029	ADELIA FITRI SYAHARANI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
16.	21030194030	CITRA DIA FADILAH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
17.	21030194040	CINTANA HANUUN JANUARIZA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
18.	21030194047	MUHAMMAD HUSEIN ASHARI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
19.	21030194050	SAIFATUN NUR HAFIDZAH Z	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
20.	21030194053	MUHAMMAD SYAHRUL ABIDIN	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
21.	21030194054	ANA SAFIRA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
22.	21030194056	SELFI NOVIA ARDANI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
23.	21030194057	AMILATUS SHOLIHAH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
24.	21030194058	YASINTA SALSABILAH RAMADANI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
25.	21030194073	ASYA FIROSUL MA'WA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
26.	21030194074	ADAM AL HALWI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
27.	21030194075	MENI FERONIKA TAINMETA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
28.	21030194086	FADIA MU'MINATUS SOLEKHA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
Tanda Tangan Dosen / Asisten																			


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PRESENSI KULIAH
 Periode 2022/2023 Genap

Mata Kuliah : Kimia Unsur
Kelas : 2021B
Prodi : S1 Pendidikan Kimia

Dosen : Prof. Dr. Achmad Lutfi, M.Pd.
 Dr. Kusumawati Dwiningsih, S.Pd., M.Pd.
 Amalia Putri Purnamasari, S.Si., M.Si.

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			10 Feb 23	17 Feb 23	24 Feb 23	03 Mar 23	10 Mar 23	17 Mar 23	24 Mar 23	31 Mar 23	07 Apr 23	14 Apr 23	21 Apr 23	05 May 23	12 May 23	19 May 23	26 May 23		
1.	21030194008	SAYYIDA ALIFIA PUTRI KARIMA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
2.	21030194010	AUFAR FATHONI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
3.	21030194011	PUTRI EGALITA SALSABILAH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
4.	21030194012	FIRDA NURRAMDANI PUTRI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
5.	21030194022	YUYUN MULYASARI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
6.	21030194031	RIZA APRILIANE	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
7.	21030194032	SALSABILA AMEILIA AS-SAHRA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
8.	21030194033	DESI DIKA SARI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
9.	21030194035	GALANG FIRMAN SYAH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
10.	21030194036	SAFIRA ADDURIYAH AULIYA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
11.	21030194037	MAYLAFAIZA IFFADA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
12.	21030194041	MUHAMAD NUZUL ROMADON	H	H	H	H	H	A	H	H	H	H	H	A	H	H	H	81.3 %	
13.	21030194045	DEWI AISYAH RAMADHANI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
14.	21030194046	MUHAMMAD SYAHRUL RAMADHANI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
15.	21030194049	ANISA NABILAH	H	H	H	H	H	S	H	H	H	H	H	A	H	H	H	87.5 %	
16.	21030194062	RIZKY FIRDAUS WIJAYA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
17.	21030194063	ADELLIA NUR KHASANAH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
18.	21030194064	DWI IRMAYANTI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
19.	21030194071	SURASTRI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
20.	21030194072	GHINA SALIMATUL FAJRIYAH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
21.	21030194078	FANIA FASYA REWANDA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
22.	21030194080	MUHAMMAD ADIB AL - AISY	H	H	H	H	H	H	H	H	H	H	A	H	H	H	H	87.5 %	
23.	21030194082	SHOFIA ANITA KARLINA	H	H	H	S	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
24.	21030194083	SALVIA SALSABILLA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
25.	21030194084	SITI ZAHRA SALSABILAH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	93.8 %	
Tanda Tangan Dosen / Asisten																			

D.1.2. Sample of statement of examination official report

(Scan Berita Acara Ujian Kimia Unsur)

D.2. SAMPLE OF STUDENT WORK

D.2.1. Sample of Test Paper



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET, DAN TEKNOLOGI
UNIVERSITAS NEGERI SURABAYA
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
JURUSAN KIMIA

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Telepon : +6231- 8298761, email: kimia@unesa.ac.id, Laman : <http://kimia.fmipa.unesa.ac.id>

FINAL EXAM OF THE EVEN SEMESTER 2022/2023

Subject : Elemental Chemistry
Department/Faculty : Chemistry / Mathematics and Natural Sciences
Program/Year : PKU 2021 and KU 2021
Day / date : Wednesday/ 7 June 2023
Time : 07.00-08.40 a.m
Lecturers : Team
Test Characteristic : Closed books/Open books/Open sources

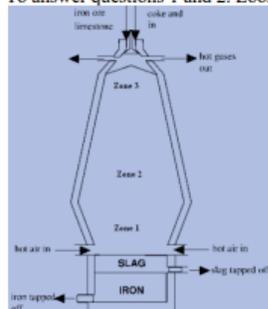
Instructions:

1. Answer all questions honestly and work independently
2. Answer the questions in each part on the different answer sheets
3. Work by handwriting on paper, give your identity (name, reg. number, class)

Problems:

Part A

To answer questions 1 and 2. Look at the picture below!



1. What iron ore can be used as a base material in the above process! (Write the name of the iron ore and its chemical formula)
2. Write down the stages (along with the reactions) that occur in the iron extraction process using a blast furnace!
3. Make and explain the Cr metal extraction process flow chart!
4. State the oxidation number of Molybdenum and examples of its compounds! The +4 and +6 oxidation states of Molybdenum are the most stable oxidation states. Why?
5. The hull of the ship which is made of iron is always in contact with sea water, causing it to corrode quickly. However, when zinc metal was added to the composition of the ship hull, the rusting process was hampered. Give an idea of why the ship hull can be protected by the zinc metal!



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Part B

1. Describe the characteristics of the elements Cu, Ag, Au based on the parameters of radius, ionization energy, sublimation enthalpy, and reduction potential!
2. Explain the application of the elements Cu, Ag, Au based on the general, physical and chemical properties of these elements!
3. Explain the difference between Zn complex compounds and other transition metal complex compounds in terms of color and magnetism!
4. Explain the toxicity of Cd and Hg elements related to the environment!

D.2.2. Sample of Student's Work

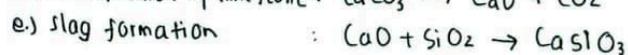
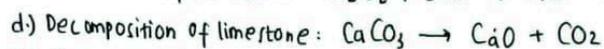
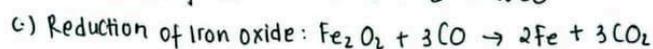
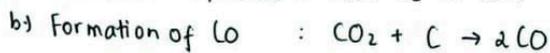
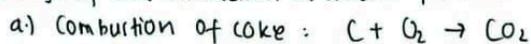
Elemental Chemistry

Part A

1.) Iron ore used in the blast furnace

→ The iron ore used is hematite (Fe_2O_3), which has a high iron content and is suitable for reduction in a blast furnace.

2.) Stage of iron extraction in a blast furnace

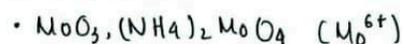
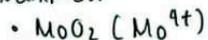


Molten iron is collected at the bottom, while slag is removed from the top.

3.) Chromium is extracted from chromite ore (FeCr_2O_4) by roasting with Na_2CO_3 in air to form sodium chromate, converting it to dichromate, and finally reducing Cr_2O_3 with aluminium (aluminothermic reduction) to obtain chromium metal.

4.) Molybdenum commonly has oxidation states +4 and +6

Examples:



The +4 and +6 states are most stable due to strong Mo-O bonding and favorable electronic configuration

5. Zinc acts as a sacrificial anode. It oxidizes more easily than iron, so zinc corrodes first and protects iron from rusting (cathodic protection).

Part B

- 1.)
 - atomic radius : $\text{Cu} < \text{Ag} < \text{Au}$
 - Ionization energy : Au is relatively high due to relativistic effects.
 - Sublimation enthalpy : High for all, especially Au
 - Reduction potential : $\text{Cu} < \text{Ag} < \text{Au}$ (Au is the most noble).

- 2.)
 - Cu \rightarrow Electrical wires and alloys
 - Ag \rightarrow Jewelry, mirrors
 - Au \rightarrow Jewelry, electronics.

- 3.) Zn^{2+} complexes are colorless and diamagnetic because of a d^{10} configuration. Other transition metal complexes are usually colored and paramagnetic due to partially filled d-orbitals.

- 4.)
 - Cd \rightarrow causes kidney damage, bone disorders
 - Hg \rightarrow form methylmercury, bioaccumulates



D.3. RECAPITULATION OF ASSESSMENT

D.3.1. Validate Test Item

The end-of-semester evaluation questions consist of eight items in the form of essay questions analyzed content through experts in the appropriate field of Chemistry Education analyzed. Essay questions are validated with expert judgment in the course team members. The analysis was conducted by taking into account several aspects, namely the suitability of the questions with the course outcome, language, content and construct.

D.3.2 Evaluation Results of Elemental Chemistry

PROGRAM STUDI S1 Pendidikan Kimia
DAFTAR NILAI MAHASISWA
Mata Kuliah : Kimia Unsur
Kelas : 2021U
Tahun Ajaran : 2022/2023 Genap

Original data :



Keterangan :

1. Komponen nilai yang diisi hanya : Part,Tugas,UTS dan UAS
2. Nilai UAS mahasiswa dengan kehadiran dibawah 73.3% (kolom dg warna merah) tidak akan disimpan
3. Jangan merubah apapun di dokumen ini kecuali pada point nomer satu di atas.
4. PPTI / BAAK tidak menerima file nilai untuk diupload. Proses upload nilai dilakukan oleh dosen pengampu yang bersangkutan.

No	NIM	Nama Mahasiswa	Angkatan	Kehadiran	Part	Tugas	UTS	UAS	NA	Huruf	Pakai
1	21030194002	REVANI PUTRI ISWAI	2021	93.75%	80	75	70	76	75.3	B+	1
2	21030194004	MERYNKE AYU NAVA TIANA	2021	93.75%	85	81	80	79	81	A-	1
3	21030194006	LILY WIDYA SARI	2021	93.75%	80	70	60	75	71.5	B	1
4	21030194009	SABRINA ANGELI ALMIRA	2021	93.75%	80	72	65	70	71.6	B	1
5	21030194016	DHEA MUTIARA FERNANDA WIBOWO	2021	93.75%	75	80	95	77	81.1	A-	1
6	21030194020	KHOLFINA FITROTIS SHOBAKHAH	2021	93.75%	75	75	80	73	75.4	B+	1
7	21030194021	ALYA AQILAH ZAHRA	2021	93.75%	75	70	65	67	69.1	B-	1
8	21030194027	SITI ANDINI AJENG PRAMESTI	2021	93.75%	80	68	50	79	70.1	B	1
9	21030194028	REVANDIKA AJI HIDAYATULLOH	2021	93.75%	80	77	80	69	75.8	B+	1
10	21030194034	RAHMANIA FITRAH SARI	2021	93.75%	70	62	70	62	65.2	B-	1
11	21030194039	PINGKY NIRMALA PRADITA	2021	93.75%	75	71	65	74	71.5	B	1
12	21030194043	SALSA SABRINA FAJAR MAULIDIAH	2021	93.75%	80	85	100	79	85.2	A	1
13	21030194044	JIHAN SAFITRI	2021	93.75%	70	70	90	60	71	B	1
14	21030194052	AUDY VIA RAHMAWATI	2021	93.75%	80	75	65	79	75.2	B+	1
15	21030194055	KHALIA ROSSIE	2021	93.75%	80	77	80	72	76.7	B+	1
16	21030194059	DIA AYU PERMATASARI	2021	93.75%	80	75	75	74	75.7	B+	1
17	21030194060	SHAFNA NOR JANAH	2021	93.75%	80	69	60	72	70.3	B	1
18	21030194061	ANDINI PUTRI TANIA	2021	93.75%	80	70	60	74	71.2	B	1
19	21030194065	LIZA NURRAHMA DWI AGUSTIN	2021	93.75%	85	80	80	73	78.9	B+	1
20	21030194066	YUNITA ANGGRAENI	2021	93.75%	85	82	90	71	80.9	A-	1
21	21030194067	BERLIANA AFSOHIN NABILA	2021	93.75%	80	76	100	65	78.3	B+	1
22	21030194068	MAHARANI DYAH ARUMSARI	2021	93.75%	80	77	65	82	76.7	B+	1
23	21030194076	ADINDA NURISKA RAGIL KINANTHI	2021	93.75%	75	64	55	60	63.2	C+	1
24	21030194079	PUTRI NURJIHAN NAJLA	2021	93.75%	80	72	65	69	71.3	B	1

PROGRAM STUDI S1 Pendidikan Kimia
 DAFTAR NILAI MAHASISWA
 Mata Kuliah : Kimia Unsur
 Kelas : 2021A
 Tahun Ajaran : 2022/2023 Genap

Original data :



Keterangan :

1. Komponen nilai yang diisi hanya : Part,Tugas,UTS dan UAS
2. Nilai UAS mahasiswa dengan kehadiran dibawah 73.3% (kolom dg warna merah) tidak akan disimpan
3. Jangan merubah apapun di dokumen ini kecuali pada point nomer satu di atas.
4. PPTI / BAAK tidak menerima file nilai untuk diupload. Proses upload nilai dilakukan oleh dosen pengampu yang bersangkutan.

No	NIM	Nama Mahasiswa	Angkatan	Kehadiran	Part	Tugas	UTS	UAS	NA	Huruf	Pakai
1	21030194001	NURIL AULIYAH SYAHIDAH	2021	93.75%	80	85.667	92	92	87.7	A	1
2	21030194003	DIVA DWI PRATIWI	2021	93.75%	80	85.333	88	82.5	83.95	A-	1
3	21030194005	ALFINA NORMA AZIZAH	2021	93.75%	80	86.333	90	89	86.6	A	1
4	21030194007	AFRILIA DWI ADELIANI	2021	93.75%	80	85.667	88	89.5	86.15	A	1
5	21030194013	FAVIAN AGUNG DIFA' SASKARA	2021	93.75%	85	87	94	80	85.9	A	1
6	21030194014	ALIVIA PUTRI RYNI	2021	93.75%	80	85.667	90	82.5	84.45	A-	1
7	21030194015	ANGGIK FEBRIANA	2021	93.75%	80	85.333	92	79.5	83.85	A-	1
8	21030194017	SRI RENATA MAHARDHIKA	2021	93.75%	80	86.333	90	87.5	86.15	A	1
9	21030194018	FADILAH MUTIARA	2021	93.75%	80	85.667	90	78.5	83.25	A-	1
10	21030194019	KHOLIFATUL NAIMAH	2021	93.75%	80	86.333	92	77	83.4	A-	1
11	21030194023	KARINA RIKE PRATIWI	2021	93.75%	82.5	86.333	92	85	86.3	A	1
12	21030194024	TUTUT SUGIARTI	2021	93.75%	80	85.333	90	86.5	85.55	A	1
13	21030194025	RATNA DWI SETYORINI	2021	93.75%	80	86.333	90	89.5	86.75	A	1
14	21030194026	NILA ZULFA IZZATI	2021	93.75%	80	85.667	90	87	85.8	A	1
15	21030194029	ADELIA FITRI SYAHARANI	2021	93.75%	80	86.333	92	84.5	85.65	A	1
16	21030194030	CITRA DIA FADILAH	2021	93.75%	82.5	85.667	90	92.5	87.95	A	1
17	21030194040	CINTANA HANUUN JANUARIZA	2021	93.75%	82.5	86	92	88	87.1	A	1
18	21030194047	MUHAMMAD HUSEIN ASHARI	2021	93.75%	81	86.333	92	83.5	85.55	A	1
19	21030194050	SAIFATUN NUR HAFIDZAH Z	2021	93.75%	80	85.667	90	77.25	82.875	A-	1
20	21030194053	MUHAMMAD SYAHRUL ABIDIN	2021	93.75%	85	87	94	92.5	89.65	A	1
21	21030194054	ANA SAFIRA	2021	93.75%	80	86	90	86	85.6	A	1
22	21030194056	SELFI NOVIA ARDANI	2021	93.75%	80	85.667	90	84.5	85.05	A	1
23	21030194057	AMILATUS SHOLIHAH	2021	93.75%	80	85.333	90	81.5	84.05	A-	1
24	21030194058	YASINTA SALSABILAH RAMADANI	2021	93.75%	80	86.333	90	84	85.1	A	1
25	21030194073	ASYA FIROSUL MA'WA	2021	93.75%	80	85.667	90	82	84.3	A-	1
26	21030194074	ADAM AL HALWI	2021	93.75%	81	87	92	86.5	86.65	A	1
27	21030194075	MENI FERONIKA TAINMETA	2021	93.75%	80	85.667	90	78	83.1	A-	1
28	21030194086	FADIA MU'MINATUS SOLEKHA	2021	93.75%	80	86.333	90	86	85.7	A	1

DAFTAR NILAI MAHASISWA
Mata Kuliah : Kimia Unsur
Kelas : 2021B
Tahun Ajaran : 2022/2023 Genap



Keterangan :

1. Komponen nilai yang diisi hanya : Part,Tugas,UTS dan UAS
2. Nilai UAS mahasiswa dengan kehadiran dibawah 73.3% (kolom dg warna merah) tidak akan disimpan
3. Jangan merubah apapun di dokumen ini kecuali pada point nomer satu di atas.
4. PPTI / BAAK tidak menerima file nilai untuk diupload. Proses upload nilai dilakukan oleh dosen pengampu yang bersangkutan.

No	NIM	Nama Mahasiswa	Angkatan	Kehadiran	Part	Tugas	UTS	UAS	NA	Huruf	Pakai
1	21030194008	SAYYIDA ALIFIA PUTRI KARIMA	2021	93.75%	80	86	90	91.5	87.25	A	1
2	21030194010	AUFAR FATHONI	2021	93.75%	80	84.333	89	87.5	85.35	A	1
3	21030194011	PUTRI EGALITA SALSABILAH	2021	93.75%	80	86.333	90	91	87.2	A	1
4	21030194012	FIRDA NURRAMDANI PUTRI	2021	93.75%	85	87.333	94	91	89.3	A	1
5	21030194022	YUYUN MULYASARI	2021	93.75%	80	86.333	90	82.5	84.65	A-	1
6	21030194031	RIZA APRILIANE	2021	93.75%	80	85	90	79.5	83.35	A-	1
7	21030194032	SALSABILA AMEILIA AS-SAHRA	2021	93.75%	80	85	92	85	85.4	A	1
8	21030194033	DESI DIKA SARI	2021	93.75%	80	85	90	86.5	85.45	A	1
9	21030194035	GALANG FIRMAN SYAH	2021	93.75%	82.5	86.333	90	92	88	A	1
10	21030194036	SAFIRA ADDURIYAH AULIYA	2021	93.75%	80	86.333	90	77.5	83.15	A-	1
11	21030194037	MAYLAFAIZA IFFADA	2021	93.75%	80	86	89	92	87.2	A	1
12	21030194041	MUHAMAD NUZUL ROMADON	2021	81.25%	80	85	94	80	84.3	A-	1
13	21030194045	DEWI AISYAH RAMADHANI	2021	93.75%	82.5	86.667	94	87	87.4	A	1
14	21030194046	MUHAMMAD SYAHRUL RAMADHANI	2021	93.75%	82.5	86.333	92	89.5	87.65	A	1
15	21030194049	ANISA NABILAH	2021	87.5%	80	85	90	81	83.8	A-	1
16	21030194062	RIZKY FIRDAUS WIJAYA	2021	93.75%	80	85.667	90	91.5	87.15	A	1
17	21030194063	ADELLIA NUR KHASANAH	2021	93.75%	80	86	90	92	87.4	A	1
18	21030194064	DWI IRMAYANTI	2021	93.75%	80	86.333	90	91.5	87.35	A	1
19	21030194071	SURASTRI	2021	93.75%	80	86	90	79	83.5	A-	1
20	21030194072	GHINA SALIMATUL FAJRIYAH	2021	93.75%	80	86.333	90	88.5	86.45	A	1
21	21030194078	FANIA FASYA REWANDA	2021	93.75%	80	86.333	90	90.5	87.05	A	1
22	21030194080	MUHAMMAD ADIB AL - AISY	2021	87.5%	79	86.333	89	80.5	83.65	A-	1
23	21030194082	SHOFIA ANITA KARLINA	2021	93.75%	80	85	90	90.5	86.65	A	1
24	21030194083	SALVIA SALSABILLA	2021	93.75%	80	85	90	79	83.2	A-	1
25	21030194084	SITI ZAHRA SALSABILAH	2021	93.75%	80	85	90	87	85.6	A	1

D.3.3 Percentage of PLO achievements of Elemental Chemistry at Academic Year 2022/2023

PLO ASSESMENT

Lecture : Elemental Chemistry
 Code : 8420403325
 Department : S1 PENDIDIKAN KIMIA
 Total of Student : 77

	CPL03	CPL06	CPL08	CPL11				
EXELENCE	74%	74%	74%	74%				
GOOD	19%	21%	22%	19%				
SATISFY	6%	5%	4%	6%				
FAILED	0%	0%	0%	0%				
Rata-rata skor	82.3	82	82	82.4				

