

# SILABUS MATA KULIAH KIMIA 1 (4 SKS)

## CHEMISTRY 1 COURSE SYLLABUS (4 CREDITS)

<b>IDENTITAS MATA KULIAH</b>  <b>COURSE IDENTITY</b>	<b>Nama Mata Kuliah</b> : <b>Kimia I</b> <i>Course Name</i> : <i>Chemistry 1</i>
	<b>Kode MK</b> : <b>SK234101</b> <i>Course Code</i> : <i>SK234101</i>
	<b>Kredit</b> : <b>4 SKS (3/0/1)</b> <i>Credits</i> : <i>4 Credits (3/0/1)</i>
	<b>Semester</b> : <b>I/II</b> <i>Semester</i> : <i>I/II</i>
	<b>Rencana Tatap Muka</b> : <b>16 minggu (32 pertemuan tatap muka, 7 pertemuan lab/praktikum)</b>
	<b>Teaching Schedule</b> : <b>16 weeks (32 face-to-face meetings, 7 lab/practicum meetings)</b>
<b>DESKRIPSI MATA KULIAH</b>  <b>COURSE DESCRIPTION</b>	<p>Sains merupakan pengetahuan secara sistematis yang diperoleh melalui observasi dan eksperimen. Kimia merupakan cabang ilmu sains yang sangat erat kaitannya dengan kehidupan sehari-hari. Mata kuliah Kimia 1 merupakan pengantar yang menyeluruh tentang dasar-dasar kimia. Dalam mata kuliah ini, mahasiswa akan memperoleh pemahaman tentang struktur atom, sifat materi, dan reaksi kimia. Materi perkuliahan ini dirancang untuk membekali mahasiswa dengan pengetahuan dasar yang diperlukan untuk memahami berbagai fenomena kimia dalam kehidupan sehari-hari maupun aplikasi dalam bidang ilmu lainnya. Selain itu, mahasiswa akan diperkenalkan dengan prinsip-prinsip laboratorium yang penting dalam penelitian dan analisis kimia. Mata kuliah ini akan memberikan pondasi yang kuat bagi mahasiswa dalam memahami konsep-konsep lanjutan pada tingkat lebih tinggi dalam bidang kimia dan disiplin ilmu lainnya, termasuk bidang rekayasa atau teknik. Dengan menyelesaikan mata kuliah ini, mahasiswa diharapkan dapat mengembangkan keterampilan analitis, kritis, dan <i>problem-solving</i> yang penting dalam studi ilmiah.</p> <p><i>Science is systemized knowledge which is obtained through observations and experiments. Chemistry is a branch of science that is belongs to every aspect of life. Chemistry 1 course is a comprehensive introduction to the basics of chemistry. In this course, students will learn about atomic structure, material properties, and chemical reactions. This learning material is designed to equip students with the basic knowledge needed to understand various chemical phenomena in everyday life and applications in other fields of study. In addition, students will be introduced to important laboratory principles in chemical research and analysis. This course will provide a strong basic for students to understand advanced concepts at a higher level in chemistry and other disciplines, including engineering field. By completing this course, students are expected to be able to develop analytical, critical, and problem-solving skills that are important in scientific studies.</i></p>
	<b>CAPAIAN PEMBELAJARAN LULUSAN YANG DIBEBANKAN MATA KULIAH</b>  <b>LEARNING OUTCOME CHARGED TO THE COURSE</b>

	<p><i>or group work in the form of final project reports or other forms of learning activities whose outcomes are equivalent to final assignments through logical, critical thinking, systematic and innovative (PLO 2)</i></p> <p><i>Department:</i></p> <p>1.</p>
<p><b>CAPAIAN PEMBELAJARAN MATA KULIAH</b></p> <p><b>COURSE LEARNING OUTCOME</b></p>	<p>1. Mahasiswa mampu menerapkan prinsip-prinsip dasar ilmu kimia sebagai dasar dalam mempelajari ilmu yang berkaitan dengan kimia.</p> <p>2. Mahasiswa dapat melakukan perhitungan-perhitungan dasar kimia</p> <p>3. Mahasiswa mampu mengumpulkan data dan informasi terkait dengan bidang kimia serta mendokumentasikannya secara detail</p> <p>4. Mahasiswa mampu menggunakan peralatan gelas dan peralatan preparatif yang lazim digunakan dalam bidang kimia dengan baik, benar, dan aman</p> <p>1. <i>The students should be able to use the principles of basic chemistry knowledge as a basis to learn chemistry in which they will learn further throughout their whole studies</i></p> <p>2. <i>The students should be able to do the basic chemistry calculations</i></p> <p>3. <i>Able to collect data and information as well as documenting in detail</i></p> <p>4. <i>The students able to use glassware and preparative equipment properly</i></p>
<p><b>POKOK BAHASAN</b></p> <p><b>SUBJECT</b></p>	<p><b>1. Struktur Atom</b></p> <ul style="list-style-type: none"> <li>• Pengenalan mengenai materi (unsur, senyawa, sifat fisika, sifat kimia)</li> <li>• Hukum-hukum dasar penggabungan unsur (Proust, Lavoisier, Dalton)</li> <li>• Perkembangan model dan struktur atom</li> <li>• Percobaan-percobaan yang mendasarinya (Dalton, Thompson, Rutherford, Bohr dan Spektrum Atom Hidrogen)</li> <li>• Konfigurasi elektron suatu unsur dan ion</li> <li>• Sistem Periodik Unsur</li> <li>• Sifat periodisitas unsur</li> </ul> <p><b>2. Atomic Structure</b></p> <ul style="list-style-type: none"> <li>• <i>Introduction to matter (elements, compounds, physical properties, chemical properties)</i></li> <li>• <i>The basic laws of combining elements (Proust, Lavoisier, Dalton)</i></li> <li>• <i>Development of atomic models and structures</i></li> <li>• <i>The underlying experiments (Dalton, Thompson, Rutherford, Bohr and the Hydrogen Atomic Spectrum)</i></li> <li>• <i>The electron configuration of an element and an ion</i></li> <li>• <i>Periodic System of Elements</i></li> <li>• <i>The periodicity of the elements</i></li> </ul> <p><b>2. Stoikhiometri</b></p> <ul style="list-style-type: none"> <li>• Perhitungan konsep mol</li> <li>• Rumus empiris dan rumus molekul</li> <li>• Satuan Konsentrasi (M, N, %, m, F, ppm, ppb)</li> <li>• Stoikhiometri dalam Larutan</li> <li>• Standarisasi</li> </ul> <p><b>2. Stoichiometry</b></p> <ul style="list-style-type: none"> <li>• <i>Calculation of the concept of mole</i></li> <li>• <i>Empirical formula and molecular formula</i></li> <li>• <i>Concentration Units (M, N, %, m, F, ppm, ppb)</i></li> <li>• <i>Stoichiometry in Solution</i></li> <li>• <i>Standardization</i></li> </ul> <p><b>5. Ikatan Kimia</b></p> <ul style="list-style-type: none"> <li>• Ikatan kovalen dan kovalen polar, momen dipol, ikatan logam, ikatan hidrogen, dan ikatan Van der Waals</li> <li>• Struktur dan bentuk geometri molekul (struktur Lewis, dan hibridisasi)</li> </ul> <p><b>3. Chemical Bond</b></p>

	<ul style="list-style-type: none"> <li>• <i>Polar covalent and covalent bonds, dipole moments, metallic bonds, hydrogen bonds, and Van der Waals bonds</i></li> <li>• <i>Molecular geometry and structure (Lewis structure, and hybridization)</i></li> </ul> <p><b>6. Wujud Zat</b></p> <ul style="list-style-type: none"> <li>• Wujud Gas (Hukum-hukum gas dan sifat fisiknya)</li> <li>• Wujud Cair (sifat fisik cairan: tekanan uap, titik didih, tegangan permukaan, viskositas)</li> <li>• Sifat Koligatif Larutan</li> <li>• Wujud Padat (kisi Kristal, kubus sederhana simple cube, kubus berpusat muka/<i>face centered cubic</i>, kubus berpusat badan/<i>body centered cubic</i>, indeks Miller, persamaan Bragg)</li> </ul> <p><b>4. State of Matter</b></p> <ul style="list-style-type: none"> <li>• <i>Forms of Gases (Laws of gases and their physical properties)</i></li> <li>• <i>Liquid State (physical properties of liquids: vapor pressure, boiling point, surface tension, viscosity)</i></li> <li>• <i>Colligative Properties of Solutions</i></li> <li>• <i>Solids (Crystal lattice, simple simple cube, face centered cubic, body centered cubic, Miller index, Bragg equation)</i></li> </ul> <p><b>7. Larutan</b></p> <ul style="list-style-type: none"> <li>• Teori Asam Basa (Teori Arrhenius, Brønsted-Lowry, Teori Lewis)</li> <li>• Derajat ionisasi dan tetapan ionisasi</li> <li>• Kekuatan Asam Basa</li> <li>• Kesetimbangan asam-basa lemah</li> <li>• Kesetimbangan ionik antara zat padat dan larutan</li> <li>• Sistem Buffer</li> <li>• Kelarutan</li> </ul> <p><b>5. Solution</b></p> <ul style="list-style-type: none"> <li>• <i>Acid-Base Theory (Arrhenius Theory, Brønsted-Lowry, Lewis Theory)</i></li> <li>• <i>Degree of ionization and ionization constant</i></li> <li>• <i>Acid Base Strength</i></li> <li>• <i>Weak acid-base balance</i></li> <li>• <i>Ionic equilibrium between solid and solution</i></li> <li>• <i>Buffer System</i></li> <li>• <i>Solubility</i></li> </ul> <p><b>8. Termodinamika</b></p> <ul style="list-style-type: none"> <li>• Konsep termodinamika (prinsip, keadaan dan proses)</li> <li>• Hukum I Termodinamika: energi dalam, kerja dan kalor</li> <li>• Kapasitas panas, kalorimetri dan entalpi</li> <li>• Hukum II Termodinamika dan spontanitas</li> <li>• Termokimia serta penggunaannya untuk menjelaskan kespontanitas reaksi kimia</li> <li>• Perhitungan yang berkaitan dengan aplikasi mesin Carnot</li> </ul> <p><b>6. Thermodynamics</b></p> <ul style="list-style-type: none"> <li>• <i>Thermodynamics concepts (principles, states and processes)</i></li> <li>• <i>First Law of Thermodynamics: internal energy, work and heat</i></li> <li>• <i>Heat capacity, calorimetry and enthalpy</i></li> <li>• <i>Second Law of Thermodynamics and spontaneity</i></li> <li>• <i>Thermochemistry and its use to explain the spontaneity of chemical reactions</i></li> <li>• <i>Calculations related to the Carnot engine application</i></li> </ul> <p><b>9. Kesetimbangan Kimia</b></p> <ul style="list-style-type: none"> <li>• Konsep Kesetimbangan Kimia dan Tetapan Kesetimbangan (Quotient reaksi, tetapan kesetimbangan <math>K_p</math> dan <math>K_c</math>)</li> <li>• Asas Le Chatelier</li> <li>• Faktor-faktor yang mempengaruhi kesetimbangan kimia</li> </ul>
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### **7. Chemical equilibrium**

- *Concept of Chemical Equilibrium and Equilibrium Constant (Reaction quotient, equilibrium constant  $K_p$  and  $K_c$ )*
- *Le Chatelier's Principle*
- *Factors affecting chemical equilibrium*

### **10. Kinetika Kimia**

- Konsep kinetika kimia
- Laju dalam reaksi kimia
- Penentuan laju reaksi, orde dan konstanta laju reaksi
- Pengaruh suhu pada laju reaksi
- Reaksi elementer
- Katalis

### **8. Chemical Kinetics**

- *Chemical kinetics concept*
- *Rate in chemical reaction*
- *Determination of reaction rate, order and rate constant of reaction*
- *Effect of temperature on reaction rate*
- *Elementary reaction*
- *Catalyst*

### **11. Elektrokimia**

- Konsep reaksi redoks
- Sel elektrokimia (elektroda dan larutan elektrolit dalam sel elektrokimia)
- Pengaruh konsentrasi dan persamaan Nerst
- Penggunaan konsep elektrokimia untuk aplikasi sel volta (baterai dan Fuel Cells) serta elektrolisis
- Korosi dan pencegahan korosi

### **9. Electrochemistry**

- *Redox reaction concept*
- *Electrochemical cell (electrode and electrolyte solution in electrochemical cell)*
- *Effect of concentration and Nerst . equation*
- *Use of electrochemical concepts for voltaic cell applications (battery and fuel cells) and electrolysis*
- *Corrosion and corrosion prevention*

### **12. Pengayaan**

Topik sesuai dengan bidang minat fakultas (per fakultas)

### **10. Enrichment**

*Topics according to the faculty's area of interest (per faculty)*

### **Rencana Modul Praktikum yang Ditawarkan**

1. Oksidasi hidrogen
2. Stoikiometri: Hukum kekekalan massa
3. Pemisahan campuran
4. Uji pH oksida
5. Pengaruh konsentrasi terhadap laju reaksi
6. Uji BOD/COD
7. Titrasi asam basa
8. Sifat larutan: elektrolit dan non-elektrolit
9. Energi bahan bakar
10. Hujan asam
11. Penentuan kandungan asam fosfat dalam *soft drink*
12. Reaksi eksotermis dan endotermis
13. Baterai berbasis timbal
14. Waktu Pelepasan Vitamin C
15. Rumus Empiris Tembaga Oksida

	<p>16. Topik-topik lain disesuaikan dengan materi pengayaan</p> <p><b><i>Practicum Module Plans Offered</i></b></p> <ol style="list-style-type: none"> <li>1. <i>Hydrogen oxidation</i></li> <li>2. <i>Stoichiometry: Law of conservation of mass</i></li> <li>3. <i>Mixed separation</i></li> <li>4. <i>Oxide pH test</i></li> <li>5. <i>Effect of concentration on reaction rate</i></li> <li>6. <i>BOD/COD Test</i></li> <li>7. <i>Acid base titration</i></li> <li>8. <i>Solution properties: electrolyte and non-electrolyte</i></li> <li>9. <i>Fuel energy</i></li> <li>10. <i>Acid rain</i></li> <li>11. <i>Determination of phosphoric acid content in soft drinks</i></li> <li>12. <i>Exothermic and endothermic reactions</i></li> <li>13. <i>Lead Storage Batteries</i></li> <li>14. <i>Time-Release Vitamin C Tablets</i></li> <li>15. <i>The Empirical Formula of a Copper Oxide</i></li> </ol> <p><i>Other topics are adapted to enrichment material</i></p>
<p><b>PRASYARAT</b></p> <p><i>Pre-Requisite Courses</i></p>	<p>-</p>
<p><b>PUSTAKA</b></p> <p><b>REFERENCE</b></p>	<ol style="list-style-type: none"> <li>1. Diktat Kimia 1 (disusun oleh Tim Dosen Departemen Kimia)</li> <li>2. Oxtoby, D.W., Gillis, H.P. and Campion, A., "Principles of Modern Chemistry", 7th Edition, Brooks/Cole, 2012.</li> <li>3. Chang, R. and Goldsby, K., "Chemistry", 11th Edition, McGraw-Hill, USA, 2012.</li> <li>4. Goldberg, D. E., "Fundamental of Chemistry", 4th Edition, McGraw-Hill Companies, 2007.</li> </ol> <ol style="list-style-type: none"> <li>1. <i>Chemistry 1 (compiled by the Lecturer Team of the Department of Chemistry)</i></li> <li>2. <i>Oxtoby, DW, Gillis, HP and Campion, A. , "Principles of Modern Chemistry", 7th Edition, Brooks/Cole, 2012.</i></li> <li>3. <i>Chang, R. and Goldsby, K., "Chemistry", 11th Edition, McGraw-Hill, USA, 2012.</i></li> <li>4. <i>Goldberg, DE, "Fundamentals of Chemistry", 4th Edition, McGraw-Hill Companies, 2007.</i></li> </ol>