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| <b>Identification</b>                          | <b>Subject</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | CHEM 111 Chemistry-1, 6 ECTS                                                                                                                                         |                       |  |
|                                                | <b>Department</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Chemistry and Chemical Engineering                                                                                                                                   |                       |  |
|                                                | <b>Program</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Undergraduate                                                                                                                                                        |                       |  |
|                                                | <b>Term</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Fall 2026                                                                                                                                                            |                       |  |
|                                                | <b>Instructor</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Valida Fataliyeva                                                                                                                                                    |                       |  |
|                                                | <b>E-mail:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <a href="mailto:valida.fataliyeva@outlook.com">valida.fataliyeva@outlook.com</a><br><a href="mailto:valida.aliyeva2023@khazar.org">valida.aliyeva2023@khazar.org</a> |                       |  |
| <b>Prerequisites</b>                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                      |                       |  |
| <b>Language</b>                                | English                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                      |                       |  |
| <b>Compulsory/Elective</b>                     | Compulsory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                      |                       |  |
| <b>Required textbooks and course materials</b> | <p>Core textbooks</p> <ol style="list-style-type: none"><li>1. Chemistry (13th edition) by Raymond Chang and Jason Overby in pdf published in 2019</li><li>2. Chemistry and chemical reactivity (9th edition), John C. Kotz, Paul M. Treichel, published in 2015</li><li>3. Chemistry The Central Science 14th Edition published in 2017</li></ol> <p>For class presentations and discussions, the student should utilize journal and internet materials. Moreover, the course does not limit the use of learning materials available at Khazar University library.</p> |                                                                                                                                                                      |                       |  |
| <b>Website of course</b>                       | This course is based on traditional face-to-face classes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                      |                       |  |
| <b>Teaching methods</b>                        | <b>Lecture</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>X</b>                                                                                                                                                             |                       |  |
|                                                | <b>Group discussion</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>X</b>                                                                                                                                                             |                       |  |
|                                                | <b>Practical tasks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>X</b>                                                                                                                                                             |                       |  |
|                                                | <b>Research from internet</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>X</b>                                                                                                                                                             |                       |  |
|                                                | <b>Others</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>X</b>                                                                                                                                                             |                       |  |
| <b>Evaluation</b>                              | <b>Methods</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Date/deadlines</b>                                                                                                                                                | <b>Percentage (%)</b> |  |
|                                                | <b>Midterm exam</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                      | 30                    |  |
|                                                | <b>Quizzes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                      | 15                    |  |
|                                                | <b>Presentation\Group work</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Last week of December                                                                                                                                                | 10                    |  |
|                                                | <b>Activity</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Every lesson                                                                                                                                                         | 5                     |  |
|                                                | <b>Final exam</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | End of the semester                                                                                                                                                  | 40                    |  |
|                                                | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                      | 100                   |  |
| <b>Description</b>                             | In this course, we study chemistry, beginning with the basics of the atom and its behavior, then progressing to the chemical properties of matter and the chemical changes and reactions that take place all the time in our world. General Chemistry-1 covers the nature of matter, stoichiometry, basic chemical reactions, Gases, thermochemistry, atomic structure and the periodic table, and chemical                                                                                                                                                             |                                                                                                                                                                      |                       |  |

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|                          | <p>bonding, the properties of solutions. In this course, students will acquire fundamental knowledge such as the structure, nature, participation of substances in reactions, determination of precipitation in reactions, stoichiometric calculations and concentrations of solutions. This course will contribute to other courses in chemistry such as analytical, organic, petrochemical, physical chemistry, etc.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Course objectives</b> | <p>Throughout this course, students will develop a fundamental understanding of chemistry, including the composition, structure, and properties of substances. The course aims to explain the relationship between molecular structure and chemical properties and to develop students' ability to perform stoichiometric calculations in chemical reactions. Students will learn to identify different types of chemical reactions, predict their direction, and determine the formation of precipitates. The course also covers the properties of gases and the application of Dalton's law of partial pressures, as well as the properties of solutions and methods for determining solution concentrations. Students will gain an understanding of chemical bonding and the differences between ionic and covalent bonds. In addition, the course introduces the basic principles of quantum mechanics, including electron orbitals and quantum numbers. Finally, students will study thermochemistry and the First Law of Thermodynamics, with particular emphasis on the concepts of work, heat, and energy changes in chemical processes.</p> |
| <b>Learning outcomes</b> | <p>Here are some common learning outcomes associated with introductory chemistry courses:</p> <p>Distinguish between the physical and chemical properties of matter;</p> <p>Describe the arrangement of the periodic table;</p> <p>Identify and write electron configurations;</p> <p>Draw Lewis structures for molecules;</p> <p>Name ionic and covalent compounds using the rules for nomenclature of inorganic compounds;</p> <p>Perform stoichiometric calculations;</p> <p>Use the Ideal Gas Law to calculate properties of gases;</p> <p>Calculate enthalpy change for a given process, and explain the relationship between enthalpy change and the tendency for reactions to occur;</p> <p>Classify solutions as acidic, basic, or neutral; determination of concentrations of solutions.</p> <p>Write and balance oxidation-reduction reactions.</p> <p>Distinguishing chemical bonds between different compounds.</p> <p>Energy calculations. Using the first law of Thermodynamics.</p> <p>Calculating quantum numbers of elements.</p>                                                                                                   |
| <b>Policy</b>            | <ul style="list-style-type: none"> <li> <b>Activity</b><br/>           Activity points serve as a measure of student engagement, participation, and understanding of fundamental concepts. They encourage active involvement in discussions, experiments, and problem-solving exercises, helping students grasp key principles more effectively. These points also contribute to overall grades, fostering consistent learning and collaboration. <b>It should be noted</b> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

**that if a student refuses to solve problems on the blackboard, answer oral questions, or complete any other assigned tasks, the corresponding activity points will be deducted.**

• **Quiz**

A consistent method of measuring your understanding of the content covered in class is through quizzes. They assist you and your teacher in evaluating your comprehension of important ideas and identifying any areas that can benefit from more explanation.

Quizzes can be considered as “preparation” for the exams. Quizzes will be held three times (or twice) during the semester and will account for a total of 15 points. Each quiz will be conducted during class and will be worth approximately 5 (or 7–8) points. Students are allowed to use a calculator during quizzes; however, the use of mobile phones, tablets, laptops, books, and notes is not permitted.

**Note:** Except in certain circumstances, students are required to participate in quizzes. In case of a valid excuse, students must inform the instructor in advance so that a make-up quiz can be arranged.

• **Presentation\Group work**

Presentation/Group Work consists of students researching a specific topic, preparing a PowerPoint presentation, presenting it face-to-face in class, and answering the questions provided by the instructor. It should be noted that presentations must be delivered in English, as this is an English-medium Chemistry course. The maximum score for the presentation/group work is 10 points.

• **Midterm Exam**

Midterm exam is important components of the academic assessment process, and it serves several crucial purposes in a student's educational journey. Midterm is held in the middle of the semester and is evaluated with a total of 30 points. The time limit of midterm exam is 90 minutes. The format of the questions will vary, but expect a range of “easy”, “medium” and “challenging” parts, with the point values for each question/part clearly labeled. During the exam, you are permitted to use a calculator (any model, provided that it has no communication ability; you also may not share calculators). The use of other electronic devices during the exam is strictly prohibited.

• **Withdrawal (pass/fail)**

The School of Engineering and Applied Science's grading guidelines are carefully adhered to throughout this course. In order to pass, a student must typically receive a mark of at least 60%.

• **Cheating/plagiarism**

Any form of plagiarism or cheating on a quiz, project or exam paper will result in the cancellation of the assignment. In this scenario, the student will receive a score of zero (zero) without any further consideration.

• **Professional behavior guidelines**

During class hours, students are expected to conduct themselves in a way that fosters a positive academic and professional atmosphere. Discussions without permission and unethical conduct are absolutely forbidden.

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|                                             | <ul style="list-style-type: none"><li>• <b>Ethics</b></li></ul> <p>During class, students are expected to arrive on time, refrain from eating or drinking anything other than water, avoid talking to each other, and refrain from any behavior that may interrupt the lesson or distract the instructor or other students. All electronic devices must be put away and turned off during class. <b>Failure to comply with these rules may result in appropriate penalties.</b></p>                                                                                                                                                                                                                                                                            |
| <b>Use of Artificial Intelligence Tools</b> | <p>The use of Generative Artificial Intelligence (GAI) tools within this course is permitted solely for educational, research, and individual learning purposes and must remain consistent with the University's principles of academic integrity. GAI tools may be used as supplementary resources to support learning and research; however, all submitted work must reflect the student's own understanding, critical thinking, and academic contribution. Any use of GAI must be appropriately disclosed in the relevant assignment, project, presentation, or other academic material. Students are fully responsible for evaluating and verifying the accuracy, reliability, and appropriateness of all AI-generated content included in their work.</p> |

|       |       | Tentative Schedule                                                                                                                                                                                                                                                                        |                     |
|-------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Weeks | Topic | Topics                                                                                                                                                                                                                                                                                    | Reference books     |
| 1     | 1     | Chemistry The Study of Change<br>1.1 Chemistry: A Science for the Twenty-First Century<br>1.2 The Study of Chemistry<br>1.3 The Scientific Method<br>1.4 Classifications of Matter<br>1.5 The Three States of Matter<br>1.6 Physical and Chemical Properties of Matter<br>1.7 Measurement | [1]<br>Pages 1-18   |
| 2     | 2     | Atoms, Molecules and Ions<br>2.1 The Atomic Theory<br>2.2 The Structure of the Atom<br>2.3 Atomic Number, Mass Number, and Isotopes<br>2.4 The Periodic Table<br>2.5 Molecules and Ions<br>2.6 Chemical Formulas<br>2.7 Naming Compounds                                                  | [1]<br>Pages 40-67  |
| 3     | 3     | Mass Relationships in Chemical Reactions<br>3.1 Atomic Mass<br>3.2 Avogadro's Number and the Molar Mass of an Element<br>3.3 Molecular Mass<br>3.4 The Mass Spectrometer<br>3.5 Percent Composition of Compounds<br>3.6 Experimental Determination of Empirical Formulas                  | [1]<br>Pages 78-107 |
| 4     | 4     | 3.7 Chemical Reactions and Chemical Equations<br>3.8 Amounts of Reactants and Products<br>3.9 Limiting Reactants<br>3.10 Reaction Yield<br><br><b>Quiz-1</b>                                                                                                                              | [1]<br>Pages 78-107 |

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| 5  | 5                   | Reaction in Aqueous Solutions<br>4.1 General Properties of Aqueous Solutions<br>4.2 Precipitation Reactions<br>4.3 Acid-Base Reactions<br>4.4 Oxidation-Reduction Reactions<br>4.5 Concentration of Solutions                              | [1]<br>Pages 121-151 |
| 6  | 6                   | Gases<br>5.1 Substances That Exist as Gases<br>5.2 Pressure of a Gas<br>5.3 The Gas Laws<br>5.4 The Ideal Gas Equation<br>5.5 Gas Stoichiometry<br>5.6 Dalton's Law of Partial Pressures                                                   | [1]<br>Page 175-202  |
| 7  | <b>Midterm exam</b> |                                                                                                                                                                                                                                            |                      |
| 8  | 7                   | Thermochemistry<br>6.1 The Nature of Energy and Types of Energy<br>6.2 Energy Changes in Chemical Reactions<br>6.3 Introduction to Thermodynamics<br>6.4 Enthalpy of Chemical Reactions<br>6.6 Standard Enthalpy of Formation and Reaction | [1]<br>Pages 230-258 |
| 9  | 8                   | Quantum Theory and the Electronic Structure of Atoms<br>7.5 Quantum Mechanics<br>7.6 Quantum Numbers<br>7.7 Atomic Orbitals<br>7.8 Electron Configuration<br>7.9 The Building-Up Principle                                                 | [1]<br>Pages 292-309 |
| 10 | 9                   | Periodic Relationships Among the Elements<br>8.1 Development of the Periodic Table<br>8.2 Periodic Classification of the Elements<br>8.3 Periodic Variation in Physical Properties                                                         | [1]<br>Pages 326-357 |

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| 11 | 10 | 8.4 Ionization Energy<br>8.5 Electron Affinity<br>8.6 Variation in Chemical Properties of the Representative Elements<br><br><b>Quiz-2</b>                                                                                       | [1]<br>Pages 326-357 |
| 12 | 11 | Chemical Bonding I<br>9.1 Lewis Dot Symbols<br>9.2 The Ionic Bond<br>9.4 The Covalent Bond<br>9.5 Electronegativity<br>9.6 Writing Lewis Structures                                                                              | [1]<br>Pages 366-384 |
| 13 | 12 | The properties of solutions<br>12.1 Types of Solutions<br>12.2 A Molecular View of the Solution Process<br>12.3 Concentration Units<br>12.4 The Effect of Temperature on Solubility                                              | [1]<br>Pages 513-541 |
| 14 | 13 | 12.5 The Effect of Pressure on the Solubility of Gases<br>12.6 Colligative Properties of Nonelectrolyte Solutions<br>12.7 Colligative Properties of Electrolyte Solutions<br><br><b>Quiz-3</b>                                   | [1]<br>Pages 513-541 |
| 15 | 14 | Chemical bonding II<br>10.1 Molecular Geometry<br>10.2 Dipole Moments<br>10.4 Hybridization of Atomic Orbitals<br>10.5 Hybridization in Molecules Containing Double and Triple Bonds<br><br><b>Presentations and Group works</b> | [1]<br>Pages 410-440 |
|    |    | <b>Final exam</b>                                                                                                                                                                                                                |                      |