# COURSE OUTLINE TEMPLATE

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|  | **SULTAN QABOOS UNIVERSITY**<br>**COLLEGE OF SCIENCE**<br>**BACHELOR OF SCIENCE IN CHEMISTRY**<br>**COURSE OUTLINE** | Other logo |

| **I. COURSE INFORMATION** | | | |
|---|---|---|---|
| **COURSE CODE** | CHEM2101 | | |
| **COURSE TITLE** | **GENERAL CHEMISTRY I** | | |
| **OMAN QUALIFICATION FRAMEWORK (OQF) LEVEL** | **5** | | |
| **CREDIT HOURS** | 4 | | |
| **CONTACT HOURS** | 6 | | |
| **PRE-REQUISITES** | FPEL0560 OR FPEL0600 OR FPEL0601 OR FPEL0602 FPEL0603 OR FPEL0604 AND (FPMT0105 OR FPMT0108 OR FPMT0109) | | |
| **CO-REQUISITES** | X | | |
| **EQUIVALENT COURSES** | X | | |
| **INCOMPATIBLE COURSES** | X | | |
| **COURSE CATEGORY** | ☐ University Requirement | ☐ University Elective | |
| | ☐ College Requirement | ☐ College Elective | |
| | ☒ Department Requirement | ☐ Department Elective | |
| | ☐ Specialization Requirement | ☐ Specialization Elective | |
| | ☐ Other (specify): | | |
| **COURSE OWNER** | College: Science | Department: Chemistry | |
| | Center: | Unit: | |
| **DELIVERY MODE** | ☒ Face to Face | ☐ Blended | ☐ Online |
| **COURSE TYPE** | ☐ Lecture | ☒ Lecture/Lab | |

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| | ☐Lecture/Seminar | ☐ Lecture/Studio | |
| | ☐ Lecture/Tutorial | ☐ Lecture/Lab/Tutorial or Seminar | |
| | ☐ Tutorial | ☐ Laboratory (Practical) | |
| | ☐ Field or Work Placement | ☐ Studio | |
| | ☐ Seminar | ☐ Internship | |
| | ☐ Workshop | ☐ Project | |
| | ☐ Thesis | ☐ Other (specify): | |
| **LANGUAGE OF INSTRUCTION** | English | | |
| **COURSE DESCRIPTION** | This course is the first of two General Chemistry courses. It is a basic course primarily intended for majors in chemistry and other related departments. It includes experiments related to basic chemical principles. It teaches students how to think like scientists and chemists so that they can apply the problem-solving method to other aspects of their lives. They use the tools to become critical thinkers, ask questions, use rules and models, and properly evaluate the outcome. The topics covered include chemical foundations; atoms, molecules, and ions; stoichiometry; types of chemical reactions and solution stoichiometry; atomic structure and periodicity; general concepts of bonding; and thermochemistry. The lab activities are designed to help students develop the practical skills required for higher-level chemistry courses while also expanding on the principles taught in lectures. | | |
| **TEACHING AND LEARNING STRATEGIES** | ☐ Augmented Reality | ☐ Flipped Classroom | |
| | ☒ Blended Learning | ☒ Problem-Based Learning | |
| | ☒ Discovery-Based Learning | ☐ Project-Based Learning | |
| | ☐ Student-Led Learning | ☐ Team-Based Learning | |
| | ☐ Work-Based Learning | ☐ Other (specify): | |
| **ASSESSMENT COMPONENT AND WEIGHT** | ☒ In-term exams (30%) | ☒ Quizzes (10%) | ☐ Other (specify): (%) |
| | ☐ Homework (%) | ☐ Project (%) | |
| | ☒ Final examination (49%) | ☒ Practical/ Lab (20%) | |
| **TEXTBOOKS AND EDUCATIONAL MATERIAL** | Textbook: Chemistry, Zumdahl S. S. & Zumdahl S. A. 9th Edition, Brooks/ Cole, Belmont (CA, USA), 2014; Lecture notes; lab manuals handouts and videos. | | |

| GRADING METHOD | ☒ A-F Scale | ☐ Pass/Not Pass | ☐ Other (specify): |
|---|---|---|---|

| GRADING METHOD DESCRIPTION | | | |
|---|---|---|---|
| A-F GRADING SCALE: | Range | Letter Grade | Description |
| | >85 | A | **Exceptional performance:** All course objectives achieved and met in a consistently outstanding manner. |
| | 85-81 | A- | |
| | 81-77 | B+ | **Very Good Performance:** The majority of the course objectives achieved (majority being at least two-thirds) and met in a consistently thorough manner. |
| | 77-73 | B | |
| | 73-68 | B- | |
| | 68-64 | C+ | **Satisfactory Performance:** At least most of course objectives have been achieved and met satisfactorily |
| | 64-66 | C | |
| | 60-55 | C- | |
| | 55-50 | D+ | **Minimally Acceptable Performance:** The course objectives met at a minimally acceptable level. |
| | 50-45 | D | |
| | <45 | F | **Unacceptable performance:** The course objectives not met at a minimally acceptable level. |
| PASS/NOT PASS: | | | |
| OTHER: | | | |

| II. SEMESTER INFORMATION | | | |
|---|---|---|---|
| SEMESTER/YEAR | Fall/2024 | SECTION(S) | 01 to 08 |
| DAY AND TIME | | VENUE(S) | |
| COURSE COORDINATOR | Usama Alshana | COURSE TEAM | Isehaq Al-Nafai<br>Amal Al-Sabahi<br>Reem Al Shidhani<br>Beena Philip<br>Muna Al-Mandhary<br>S. Naheed Furqan<br>Sindhu Nair |
| COORDINATOR OFFICE | 2024 | OFFICE HOURS | To be determined |

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|---|---|---|---|
| | | | later |
| **COORDINATOR EXTENSION** | 2437 | **COORDINATOR EMAIL** | u.alshana@squ.edu.om |

| **III. ALIGNMENT OF COURSE LEARNING OUTCOMES (CLO), PROGRAM LEARNING OUTCOMES (PLO), GRADUATE ATTRIBUTES (GA), AND OMAN QUALIFICATION FRAMEWORK (OQF) CHARACTERISTICS** | | | |
|---|---|---|---|
| **CLO** | **PLO** | **SQU GA** | **OQF CHARACTERISTICS (LEVEL)** |
| **1. Perform scientific measurements/conversions applying rules of significant figures, analyze quality of scientific data and classify matter** | **1<br>2<br>3** | **1<br>2** | **1<br>2<br>6** |
| **2. Know atomic structure, molecules and ions, the periodic table and name simple ions/compounds** | **1<br>2<br>3** | **1<br>2** | **1<br>2<br>6** |
| **3. Apply the stoichiometry concept to chemical equations** | **1<br>2<br>3** | **1<br>2** | **1<br>2** |
| **4. Distinguish types of chemical reactions and use solution stoichiometry** | **1<br>2<br>3** | **1<br>2** | **1<br>2** |
| **5. Understand the theories and principles that led to the development of atomic structure** | **1<br>2<br>3** | **1<br>2** | **1<br>2** |
| **6. Understand the general concepts of chemical bonding** | **1<br>2<br>3** | **1<br>2** | **1<br>2** |
| **7. Understand and apply some general concepts of thermochemistry** | **1<br>2<br>3** | **1<br>2** | **1<br>2** |

| IV. Course Learning Outcomes (CLOs) and Assessment Criteria and Methods (for each CLO) | | |
|---|---|---|
| **CLO1: Perform scientific measurements/conversions applying rules of significant figures, analyze quality of scientific data and classify matter** | | |
| **Assessment Criteria (to achieve this objective, the student must)** | | **Assessment Methods** |
| **A)** | Perform scientific measurements and mathematical operations applying rules of significant figures | Lab experiment/report, Quiz and Exams |
| **B)** | Analyze the quality of scientific data in terms of accuracy and precision and recognize types of errors | Lab experiment/report, Quiz and Exams |
| **C)** | Classify matter and identify chemical and physical properties of matter | Lab experiment/report, Quiz and Exams |
| **CLO2: Know atomic structure, molecules and ions, the periodic table and name simple ions/compounds** | | |
| **Assessment Criteria (to achieve this objective, the student must)** | | **Assessment Methods** |
| **A)** | Calculate the number of sub-atomic particles in atoms/ions and name them | Quiz and Exams |
| **B)** | Distinguish between chemical reactions and physical processes and exemplify them | Lab experiment/report, Quiz and Exams |
| **C)** | Name the elements in the periodic table, write their chemical symbols and describe some periodic trends | Quiz and Exams |
| **D)** | Make and record observations of chemical reactions and represent reactions with chemical equations | Lab experiment/report and Exams |
| **CLO3: Apply the stoichiometry concept to chemical equations** | | |
| **Assessment Criteria (to achieve this objective, the student must)** | | **Assessment Methods** |
| **A)** | Determine chemical formulae of compounds using the mole concept | Lab experiment/report and Exams |
| **B)** | Carry out stoichiometric calculations for chemical reactions | Lab experiment/report and Exams |
| **C)** | Find percent composition of compounds to determine their empirical and molecular formulae | Lab experiment/report and Exams |

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| **D)** | Balance chemical equations and apply stoichiometric calculations to find amounts of reactants and products (yield) | Lab experiment/report and Exams |
| **CLO4: DISTINGUISH TYPES OF CHEMICAL REACTIONS AND USE SOLUTION STOICHIOMETRY** | | |
| **ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)** | | **ASSESSMENT METHODS** |
| **A)** | Describe the nature of aqueous solutions as strong and weak electrolytes | Exams |
| **B)** | Prepare standard solutions, carry out dilutions and analyze the composition of substances in solution | Lab experiment/report and Exams |
| **C)** | Identify different types of reactions and perform pertinent calculations of amounts of substances/mixtures | Lab experiment/report and Exams |
| **D)** | Carry out chemical reactions and perform titrimetric analyses | Lab experiment/report and Exams |
| **E)** | Balance oxidation–reduction reactions | Exams |
| **CLO5: UNDERSTAND THE THEORIES AND PRINCIPLES THAT LED TO THE DEVELOPMENT OF ATOMIC STRUCTURE** | | |
| **ASSESSMENT CRITERIA (TO ACHIEVE THIS OBJECTIVE, THE STUDENT MUST)** | | **ASSESSMENT METHODS** |
| **A)** | Enumerate and explain the theories and principles that led to the development of the atomic structure | Exams |
| **B)** | Draw and describe atomic orbitals and assign them quantum numbers | Exams |
| **C)** | Write electronic configurations for atoms and monatomic ions and explain some trends in the periodic table | Exams |
| **CLO6: UNDERSTAND THE GENERAL CONCEPTS OF CHEMICAL BONDING** | | |
| **A)** | Understand the types of chemical bonds and bonding | Exams |
| **B)** | Draw Lewis structures, predict shapes of simple molecules and polyatomic ions and assign polarity | Exams |
| **C)** | Explain some exceptions to the Octet Rule | Exams |
| **D)** | Draw resonance structures and assign formal charges to | Exams |

| | | |
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| | atoms | |
| **E)** | Draw molecular structures using the VSEPR model, name their shapes and determine bond angles | Exams |
| **CLO7: UNDERSTAND AND APPLY SOME GENERAL CONCEPTS OF THERMOCHEMISTRY** | | |
| **A)** | Understand the nature of chemical energy and work | Exams |
| **B)** | Measure heat of chemical reactions using calorimetry and apply the first law of thermodynamics | Exams |
| **C)** | Determine/calculate heat of reactions using Hess's law and/or standard enthalpies of formation of substances | Exams |

| **V. COURSE CONTENT AND SCHEDULE** | | | | |
|---|---|---|---|---|
| **WEEK** | **LECTURES #** | **TOPICS/ SUBJECTS** | **READINGS/ CHAPTERS** | **REMARKS (e.g., ASSESSMENTS)** |
| **1** | 1 & 2 | Chemical Foundations | Chapter 1 | Quiz 1, Test 1 & Final |
| **2** | 1 & 2 | Chemical Foundations | Chapter 1 | Quiz 1, Test 1 & Final |
| **3** | 1 & 2 | Atoms, Molecules, and Ions | Chapter 2 | Lab report, Quiz 1, Test 1 & Final |
| **4** | 1<br>2 | Atoms, Molecules, and Ions<br>Stoichiometry | Chapter 2<br>Chapter 3 | Lab report, Quiz 1, Test 1 & Final |
| **5** | 1 & 2 | Stoichiometry | Chapter 3 | Lab report, Quiz 1, Test 1 & Final |
| **6** | 1<br>2 | Stoichiometry<br>Types of Chemical Reactions and Solution Stoichiometry | Chapter 3<br>Chapter 4 | Lab report, Test 1 & Final |
| **7** | 1 & 2 | Types of Chemical Reactions and Solution Stoichiometry | Chapter 4 | Lab report, Test 1 & Final |
| **8** | 1 | Types of Chemical | Chapter 4 | Lab report, Test 1 & Final |

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| | 2 | Reactions and Solution Stoichiometry Electrochemistry | Chapter 18 | |
| **9** | 1 & 2 | Atomic Structure and Periodicity | Chapter 7 | Test 2 & Final |
| **10** | 1 & 2 | Atomic Structure and Periodicity | Chapter 7 | Test 2 & Final |
| **11** | 1<br>2 | Atomic Structure and Periodicity<br>Bonding: General Concepts | Chapter 7<br>Chapter 8 | Test 2 & Final |
| **12** | 1 & 2 | Bonding: General Concepts | Chapter 8 | Test 2 & Final |
| **13** | 1<br>2 | Bonding: General Concepts<br>Covalent Bonding: Orbitals | Chapter 8<br>Chapter 9 | Test 2 & Final |
| **14** | 1 & 2 | Thermochemistry | Chapter 6 | Final Exam |
| **15** | 1 & 2 | Thermochemistry | Chapter 6 | Final Exam |

## VI. Additional Information (e.g., Rubrics, etc.)

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## VII. Students Responsibilities

It is the student's responsibility to know and comply with all University Academic Regulations relevant to participation in this course. These regulations specifically include attendance requirements and student academic code of conduct.

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| **ACADEMIC INTEGRITY** | The University expects the students to approach their academic endeavors with the highest academic integrity. Please refer to the **Undergraduate Academic Regulations**. |
| **ADD AND DROP** | Students who wish to drop or add the course should review the **Undergraduate Academic Regulations**. |
| **ATTENDANCE** | Sultan Qaboos University has a clear requirement for students to attend courses as detailed in the **Undergraduate Academic Regulations**. |
| **ASSESSMENT AND GRADING** | To ensure the provision of a sound and fair assessment and grading, please review the **Undergraduate Academic Regulations**. |
| **GRADE APPEAL** | Students who wish to appeal their grades should review the **Undergraduate Academic Regulations**. |
| **CLASSROOM POLICIES** | Students are expected to dress professionally during class time as required by the University. Use of phones or any other electronic devices in the classroom during class time is strictly prohibited. Unauthorized use may lead to faculty member confiscation of the device for the remainder of the class. Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. A student responsible for disruptive behavior may be required to leave the class. |
| **LATE AND MAKE-UP WORK** | Students are required to meet the course objectives by submitting coursework no later than the assigned due date. Students may be allowed to submit late work if approved by the Course Coordinator. Assignments submitted after the due date may be penalized. |
| **MISSED EVALUATIONS** | All quizzes, tests, clinical evaluations, and exams must be completed by the date they are assigned. If a quiz, test, or exam is missed due to a documented emergency situation (e.g., medical emergency, death in the immediate family), it is the student's responsibility to contact the instructor and/or Course Coordinator. Makeup exams will not be given for assessment criteria less than 25% of the course grade, but marks will be normalized over the other assessment components for students with valid proof of emergency situation (e.g. medical sick leave) |
| **OTHER** | - |

## Course Outline Appendix

### A. PROGRAM LEARNING OUTCOMES

1. Perform scientific measurements and mathematical operations applying rules of significant figures
2. Analyze the quality of scientific data in terms of accuracy and precision and recognize types of errors
3. Classify matter and identify chemical and physical properties of matter
4. Distinguish between chemical reactions and physical processes, and exemplify them
5. Name the elements in the periodic table, write their chemical symbols and describe the periodic trends
6. Make and record observations of chemical reactions and represent reactions with chemical equations
7. Determine chemical formulae of compounds using the mole concept
8. Carry out stoichiometric calculations for chemical reactions
9. Prepare standard solutions, carry out dilutions and analyze the composition of substances in solution
10. Identify different types of reactions and perform pertinent calculations of amounts of substances
11. Carry out chemical reactions and perform titrimetric analyses
12. Measure heats of reaction using calorimetry and apply the first law of thermodynamics
13. Determine heats of reaction using Hess's law or standard enthalpies of formation of substances
14. Enumerate and explain the theories and principles that led to the development of atomic structure
15. Draw and describe atomic orbitals, and assign them quantum numbers
16. Write electron configurations for atoms and monatomic ions and explain the periodic trends
17. Draw Lewis structures and predict shapes of simple molecules and polyatomic ions, and assign polarity

18. Describe and explain chemical bonding in terms of hybridization and types of chemical bonds
19. Integrate scientific knowledge to make informed judgements and solve problems
20. Use scientific equipment competently, interpret data and judge the quality of measurements.

**B. SQU GRADUATE ATTRIBUTES**

1. Cognitive Capabilities
2. Skill and Professional Capability
3. Effective Communication
4. Autonomy and Leadership
5. Responsibility and Commitment
6. Development and Innovation

**C. OQF CHARACTERISTICS**

1. Knowledge
2. Skills
3. Communication, Numeracy, and Information and Communication Technology Skills.
4. Autonomy and Responsibility
5. Employability and Values
6. Learning to learn