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| 1. **Institution and Course Information** | |
| Name of Institution | **Navajo Technical University** |
| Department | **Science** |
| Course Number, Title, Credits | **CHM 120 General Chemistry I (4)** |
| Co-requisite Course Number and Title, if any |  |
| Is this application for your system (ENMU, NMSU, & UNM)? |  |
| Name and Title of Contact Person | **Thiagarajan Soundappan, Department Chairperson** |
| Email and Phone Number of Contact Person | **tsoundappan@navajotech.edu; 505-786-4100** |

**Was this course previously part of the general education curriculum?**

Yes No

**This course will fulfill general education requirements for (check all that apply):**

AA/AS/BA/BS  **AAS**

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| 1. Content Area and Essential Skills |

**To which content area should this course be added?** *Indicate “Other” if the course is not associated with one of the six NM General Education content areas.*

Communications Mathematics Science Social & Behavioral Sciences

Humanities Creative & Fine Arts Other

**Which essential skills will be addressed?**

Communication Critical Thinking Information & Digital Literacy

Quantitative Reasoning Personal & Social Responsibility

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| 1. Learning Outcomes |

**This course follows the CCNS SLOs for**

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| CHEM 1215C. General Chemistry I Lecture and Laboratory for STEM Majors. This course is intended to serve as an introduction to General Chemistry for students enrolled in science, engineering, and certain preprofessional programs. Students will be introduced to several fundamental concepts, including mole, concentration, heat, atomic and molecular structure, periodicity, bonding, physical states, stoichiometry, and reactions. The laboratory component is designed to complement the theory and concepts presented in lecture, and will introduce students to techniques for obtaining and analyzing experimental observations pertaining to chemistry using diverse methods and equipment. |

**List all learning outcomes that are shared between course sections at your institution.**

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| **Common Course Student Learning Outcomes (find Common Course SLOs at:** [**http://www.hed.state.nm.us/programs/request-a-change-to-the-nmccns.aspx**](http://www.hed.state.nm.us/programs/request-a-change-to-the-nmccns.aspx)**)** |
| **Lecture Student Learning Outcomes**  1. Use dimensional analysis, the SI system of units and appropriate significant figures to solve quantitative calculations in science.  2. Explain the structure of atoms, isotopes and ions in terms of subatomic particles.  3. Understand the differences between physical and chemical changes to matter, and utilize the IUPAC system of nomenclature and knowledge of reaction types to describe chemical changes, predict products and represent the process as a balanced equation.  4. Apply the mole concept to amounts on a macroscopic and a microscopic level and use this to perform stoichiometric calculations including for reactions in solution, gases and thermochemistry.  5. Apply the gas laws and kinetic molecular theory to relate atomic level behavior to macroscopic properties.  6. Describe the energy conversions that occur in chemical reactions and state changes, relating heat of reaction to thermodynamic properties such as enthalpy and internal energy, and apply these principles to measure and calculate energy changes in reaction.  7. Use different bonding models to describe formation of compounds (ionic and covalent), and apply knowledge of electronic structure to determine molecular spatial arrangement and polarity.  8. Analyze how periodic properties (e.g. electronegativity, atomic and ionic radii, ionization energy, electron affinity, metallic character) and reactivity of elements results from electron configurations of atoms.  **Laboratory Student Learning Outcomes**  1. Demonstrate and apply concepts associated with laboratory safety, including the possible consequences of not adhering to appropriate safety guidelines.  2. Demonstrate the computational skills needed to perform appropriate laboratory related calculations to include, but not be limited to determining the number of significant figures in numerical value with the correct units, solving problems using values represented in exponential notation, solving dimensional analysis problems, and manipulating mathematical formulas as needed to determine the value of a variable.  3. Perform laboratory observations (both qualitative and quantitative) using sensory experience and appropriate measurement instrumentation (both analog and digital).  4. Prepare solutions with an acceptable accuracy to a known concentration using appropriate glassware.  5. Master basic laboratory techniques including, but not limited to weighing samples (liquid and solid), determining sample volumes, measuring the temperature of samples, heating and cooling a sample or reaction mixture, decantation, filtration, and titration.  6. Demonstrate mastery in experimental techniques, such as chromatography, filtration, and distillation experiments.  7. Draw conclusions based on data and analyses from laboratory experiments.  8. Present experimental results in laboratory reports of appropriate length, style and depth, or through other modes as required.  9. Relate laboratory experimental observations, operations, calculations, and findings to theoretical concepts presented in the complementary lecture course.  10. Design experimental procedures to study chemical phenomena. |

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| **Institution-specific Student Learning Outcomes** |
| List institution-specific Student Learning Outcomes |

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| 1. Narrative |

**Explain what students are going to do to develop the critical skills** (selected above) **and how you will assess their learning?**

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| **Communication.** *Genre and Medium Awareness, Application and Versatility; Strategies for Understanding and Evaluating Messages; and Evaluation and Production of Arguments.* |
| In this box, provide a narrative that explains how the proposed course addresses the outcomes of the first essential skill. 200 – 300 words. |

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| **Critical Thinking.** *Problem Setting; Evidence Acquisition; Evidence Evaluation; and Reasoning/Conclusion* |
| General Chemistry lecture and lab activities will provide the students the basic knowledge, critical thinking about chemistry and chemical reactions and fundamentals. The students will learn about the laboratory safety, determination of mass, use of chemical glassware, determination of melting, boiling point, identification of chemical substances, molecular shapes, structures, and classification of chemical reactions. Students are taught and evaluated in the various general chemistry aspects. Student learning process will be assessed through assignments, quiz, and lab reports etc. All the lecture classes are integrated with hands-on learning activities. Students will get the training to determine the mass, density, boiling point, and melting point of unknown compounds. In particular, dimensional analysis, and unit conversions are specific critical thinking aspects, regularly used in our life, will be taught in this course. |

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| **Quantitative Reasoning.** *Communication/Representation of Quantitative Information; Analysis of Quantitative Arguments; and Application of Quantitative Models* |
| General chemistry offers students both qualitative and quantitative information. Lecture classes will cover the chemical foundations such as scientific method, units of measurements, significant figures and calculations, learning to solve problems systematically, dimensional analysis, atoms, molecules, and ions, and history of chemistry. Also, the fundamental chemical laws, modern view of atomic structures, molecules, ions, introduction to periodic table and naming compounds. Furthermore, stoichiometric reactions, types of chemical reactions, solutions in stoichiometry, and gases will be discussed in detail. Also, related lab sessions will be conducted which will help students to understand more about the general chemistry. |

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| **Personal & Social Responsibility***. Intercultural reasoning and intercultural competence; Sustainability and the*  *natural and human worlds; Ethical reasoning; Collaboration skills, teamwork and value systems; and Civic discourse, civic knowledge and engagement – local and global* |
| All the general chemistry lab experiments will be conducted as a team work. Students will form their own team and work together to complete all the lab tasks. During the lab session, students will learn about the importance of the team work. Also, this course is general chemistry course with hands-on lab activities. Therefore, all the students will get the opportunity to learn and discover new information about chemicals, structures, reactions, able to read basic research articles, able to observe and take notes, able to understand the local, global chemical problems, and their social responsibility. |

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| **Information & Digital Literacy.** *Authority and Value of Information; Digital Literacy; Information Structure; and Research as Inquiry* |
| In this box, provide a narrative that explains how the proposed course addresses the outcomes of the third essential skill. 200 – 300 words. |

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| 1. Supporting Documents |

**Sample Course Rubric Attached** (recommended) **Sample Assessment Attached** (required)

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| 1. Assessment Plan (Must be on file with HED by August 1, 2019) |

**Link to Institution’s General Education Assessment Plan** Click here to enter text.

This course meets Navajo Tech's institutional standards for General Education and has been reviewed and approved by our General Education Committee and Assessment Committee. Student learning data will be gathered from the last of the course's project assignments. Data summaries from all sections of the course will be compiled on a semester-by-semester basis by the University's Offices of Assessment and Institutional Research. Departmental faculty will review the data and design course and GenEd program improvements during Assessment Days each semester. An annual summary that includes summaries of program improvement will be prepared by the Assessment Committee and included in the University's Annual Student Learning Report. Curriculum revisions as needed will be designed by the General Education Committee and reviewed and approved by the Faculty Congress.

**This course meets institutional standards for general education.**

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Signature of Chief Academic Officer Date

**HED Internal Use Only**

Presented to NMCC on\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date

Approved Denied

If denied, rationale:

Institution Notified on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date

**Sample Assessment: The Determination of Boiling Point: Unknown substance**

**Assignment steps:**

1. Using a handbook of chemical data or an online reference find the boiling points (at 1 atm) for the following substances

a. acetone

b. methanol

2. What temperature should a properly working thermometer display in an ice-water slush bath? In a boiling water bath?

3. What is the purpose of the short length of broken capillary tube used in the determination of boiling point?

4. What is a characteristic property of a pure substance? Is the boiling point of a substance a characteristic property?

5. Calibrate the thermometer

6. Setup the boiling point apparatus as shown in the lab manual.

7. Obtain the unknown liquid for boiling-point determination, seal it properly and place it in the apparatus setup.

8. Write your results/observations including calibration of thermometer, and boiling point of an unknown substance. Also, write your conclusion (your understanding about determining the boiling point).

**Rubric**

**CRITICAL THINKING RUBRIC**

**Adapted from NMHED Critical Thinking rubric • Navajo Technical University**

Student: Date:

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| OUTCOMES | SCALE | | | SUBTOTALS & COMMENTS |
| Emerging (1 pts) | Developing (2 pts) | Proficient (3 pts) |
| *Formulate a research question* | Student states prob­lem/question appropriate to the context. | Student states and defines an open ended prob­lem/question appropriate to the context. | Student states, defines, and describes components of an open-ended prob­lem/-question appropriate to the context. |  |
| *Gather infor­mation about the research question* | Student gathers evidence addressing the prob­lem/question from a mix of sources. | Student gathers evidence ad­dressing the prob­lem/question from sources appropriate to the context while demonstrating some awareness of acquisition pro­cess, including personal as­sumptions. | Student is able to evaluate credibility and relevance of sources in addition to demon­strating an aware-ness of the evaluation pro-cess, including personal assumptions. |  |
| *Evaluate data for credibility* | Student is able to describe appropriate sources. | Student is sometimes able to evaluate credibility and rele­vance of sources in addition to demonstrating some aware­ness of the evaluation pro­cess, including personal as­sumptions. | Student is able to evaluate credibility and relevance of sources in addition to demon­strating an awareness of the evaluation process, including personal assumptions. |  |
| *Develop a conclusion* | Student can sometimes identify common logical flaws. Can sometimes de­scribe weak and strong ar­guments. | Student can identify common logical flaws. Can sometimes differentiate weak and strong arguments. Can sometimes identify and employ evidence and reasoning to build an ar­gument and reach probable conclusions/solutions based on evidence. | Student can identify common logical fallacies. Can differenti­ate weak and strong argu­ments. Can identify and em­ploy evidence and reasoning to build an argument and reach probably conclu­sions/solutions based on ev­idence. |  |
| TOTAL/COMMENTS | | | | |

Scale: 12-11 points = A; 10-9 points = B; 8-7 points = C; 6-5 points = D; less than 5 points = F