

## TOI-6

**TOI6 Learning Objective 1:** Students will be able to explain and appropriately utilize basic scientific language and concepts.

**TOI6 Learning Objective 2:** Students will be able to design or conduct an experiment or analysis suitable to test a scientific hypothesis and be able to interpret the results.

**TOI6 Learning Objective 3:** Students will be able to solve problems described verbally, graphically, symbolically, or numerically.

| Criteria   | Exceeds Expectations  | Meets Expectations  | Working Towards Expectations   | Did Not Meet Expectations   | Not Applicable                           |
|--|---|---|--|---|--|
| <b>Scientific Language &amp; Concepts</b> (Objective 1: Students will be able to explain and appropriately utilize basic scientific language and concepts.)  | <ul style="list-style-type: none"> <li>• Applies scientific vocabulary with precision and accuracy.</li> <li>• Accurately explains concepts.</li> <li>• Integrates terminology appropriately in both written and oral communication in multiple contexts.</li> </ul>  | <ul style="list-style-type: none"> <li>• Uses scientific language correctly in most cases.</li> <li>• Explains concepts with only minor errors.</li> <li>• Applies terminology appropriately in familiar contexts.</li> </ul>   | <ul style="list-style-type: none"> <li>• Uses some correct terms but with frequent errors or superficial explanations.</li> <li>• Partially explains concepts, failing to make connections between concepts.</li> <li>• Relies on vague or colloquial language.</li> </ul>   | <ul style="list-style-type: none"> <li>• Demonstrates minimal recognition of scientific terms.</li> <li>• Misuses terminology or applies concepts incorrectly.</li> <li>• Cannot describe or use basic scientific principles.</li> </ul>  | Criterion not evaluated in this context. |
| <b>Experimental Design &amp; Analysis</b> (Objective 2: Students will be able to design or conduct an experiment or analysis suitable to test a scientific hypothesis and be able to interpret the results.) | <ul style="list-style-type: none"> <li>• Develops a well-structured, feasible experiment or analysis that directly tests a hypothesis.</li> <li>• Appropriate controls, variables, and methods are properly identified.</li> <li>• Interprets results thoughtfully, noting limitations and implications.</li> <li>• Connects findings to hypothesis, scientific concepts, or literature.</li> </ul> | <ul style="list-style-type: none"> <li>• Designs/conducts a mostly feasible experiment or analysis.</li> <li>• Identifies variables, controls, and methods with some accuracy.</li> <li>• Provides a clear interpretation of results, though depth may be limited.</li> <li>• Connects findings to the hypothesis.</li> </ul> | <ul style="list-style-type: none"> <li>• States a hypothesis and outlines a method, but with limited rigor or feasibility.</li> <li>• Incomplete identification of variables or procedures.</li> <li>• Interpretation of results is brief, vague, or partially inaccurate.</li> <li>• Minimal connection of findings to hypothesis.</li> </ul> | <ul style="list-style-type: none"> <li>• Cannot formulate a testable hypothesis or design a viable experiment or analysis.</li> <li>• Lacks recognition of variables or methods.</li> <li>• Does not interpret or misinterprets results.</li> <li>• Little to no connection made to hypothesis or scientific principles.</li> </ul> | Criterion not evaluated in this context. |
| <b>Problem Solving</b> (Objective 3: Students will be able to solve problems described verbally, graphically, symbolically, or numerically.)   | <ul style="list-style-type: none"> <li>• Accurately solves problems presented verbally, graphically, symbolically, and/or numerically.</li> <li>• Constructs a clear definition of the problem, thoroughly evaluates potential solutions, and applies reasoning flexibly.</li> </ul>  | <ul style="list-style-type: none"> <li>• Solves problems in at least two or more representations with accuracy.</li> <li>• Defines the problem adequately, proposes some solutions, and identifies some outcomes.</li> </ul>  | <ul style="list-style-type: none"> <li>• Solves problems primarily in one representation.</li> <li>• Does not fully define the problem, one solution presented but not well-described, few outcomes identified.</li> </ul>   | <ul style="list-style-type: none"> <li>• Struggles to approach or solve problems in any representation.</li> <li>• Does not define the problem, does not present viable solutions, no outcomes identified.</li> </ul>   | Criterion not evaluated in this context. |

**Problem Solving** is the process of designing, evaluating, and implementing a strategy to answer an open-ended question or achieve a desired goal.

## TOI-6L

**TOI6 Laboratory Learning Objective:** Through application-based experiences utilizing the scientific method, students will be able to identify problems, make observations, analyze data, interpret data, and develop models or explanations.

| Criteria   | Exceeds Expectations  | Meets Expectations  | Working Towards Expectations   | Did Not Meet Expectations   | Not Applicable                           |
|--|---|---|--|---|--|
| <b>Scientific Language &amp; Concepts</b> (Objective 1: Students will be able to explain and appropriately utilize basic scientific language and concepts.)  | <ul style="list-style-type: none"> <li>• Applies scientific vocabulary with precision and accuracy.</li> <li>• Accurately explains concepts.</li> <li>• Integrates terminology appropriately in both written and oral communication in multiple contexts.</li> </ul>  | <ul style="list-style-type: none"> <li>• Uses scientific language correctly in most cases.</li> <li>• Explains concepts with only minor errors.</li> <li>• Applies terminology appropriately in familiar contexts.</li> </ul>   | <ul style="list-style-type: none"> <li>• Uses some correct terms but with frequent errors or superficial explanations.</li> <li>• Partially explains concepts, failing to make connections between concepts.</li> <li>• Relies on vague or colloquial language.</li> </ul>   | <ul style="list-style-type: none"> <li>• Demonstrates minimal recognition of scientific terms.</li> <li>• Misuses terminology or applies concepts incorrectly.</li> <li>• Cannot describe or use basic scientific principles.</li> </ul>  | Criterion not evaluated in this context. |
| <b>Experimental Design &amp; Analysis</b> (Objective 2: Students will be able to design or conduct an experiment or analysis suitable to test a scientific hypothesis and be able to interpret the results.) | <ul style="list-style-type: none"> <li>• Develops a well-structured, feasible experiment or analysis that directly tests a hypothesis.</li> <li>• Appropriate controls, variables, and methods are properly identified.</li> <li>• Interprets results thoughtfully, noting limitations and implications.</li> <li>• Connects findings to hypothesis, scientific concepts, or literature.</li> </ul> | <ul style="list-style-type: none"> <li>• Designs/conducts a mostly feasible experiment or analysis.</li> <li>• Identifies variables, controls, and methods with some accuracy.</li> <li>• Provides a clear interpretation of results, though depth may be limited.</li> <li>• Connects findings to the hypothesis.</li> </ul> | <ul style="list-style-type: none"> <li>• States a hypothesis and outlines a method, but with limited rigor or feasibility.</li> <li>• Incomplete identification of variables or procedures.</li> <li>• Interpretation of results is brief, vague, or partially inaccurate.</li> <li>• Minimal connection of findings to hypothesis.</li> </ul> | <ul style="list-style-type: none"> <li>• Cannot formulate a testable hypothesis or design a viable experiment or analysis.</li> <li>• Lacks recognition of variables or methods.</li> <li>• Does not interpret or misinterprets results.</li> <li>• Little to no connection made to hypothesis or scientific principles.</li> </ul> | Criterion not evaluated in this context. |
| <b>Problem-Solving</b> (Objective 3: Students will be able to solve problems described verbally, graphically, symbolically, or numerically.)   | <ul style="list-style-type: none"> <li>• Accurately solves problems presented verbally, graphically, symbolically, and/or numerically.</li> <li>• Constructs a clear definition of the problem, thoroughly evaluates potential</li> </ul>   | <ul style="list-style-type: none"> <li>• Solves problems in at least two or more representations with accuracy.</li> <li>• Defines the problem adequately, proposes some solutions, and identifies some outcomes.</li> </ul>  | <ul style="list-style-type: none"> <li>• Solves problems primarily in one representation.</li> <li>• Does not fully define the problem, one solution presented but not well-described, few outcomes identified.</li> </ul>   | <ul style="list-style-type: none"> <li>• Struggles to approach or solve problems in any representation.</li> <li>• Does not define the problem, does not present viable solutions, no outcomes identified.</li> </ul>   | Criterion not evaluated in this context. |

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|  | solutions, and applies reasoning flexibly.   |  |  |   |  |
| <p><b>Application of the Scientific Method</b><br/>(Laboratory Objective: Through application-based experiences utilizing the scientific method, students will be able to identify problems, make observations, analyze data, interpret data, and develop models or explanations.)</p> | <ul style="list-style-type: none"> <li>Clearly identifies complex problems and researchable questions.</li> <li>Makes systematic and accurate observations.</li> <li>Analyzes and interprets data with depth, noting trends, limitations, and uncertainties.</li> <li>Develops well-supported models, hypotheses, or explanations that extend understanding beyond the data.</li> <li>Proposes well-designed experiments to test hypotheses.</li> <li>Demonstrates ability to generalize findings or apply to new contexts.</li> </ul> | <ul style="list-style-type: none"> <li>Identifies clear and relevant problems or questions in most cases.</li> <li>Makes accurate observations in most cases.</li> <li>Analyzes and interprets data adequately.</li> <li>Develops models or explanations that are supported by evidence, though somewhat limited in scope.</li> <li>Proposes reasonable experiments to test hypotheses.</li> </ul> | <ul style="list-style-type: none"> <li>Identifies a problem/question with partial clarity.</li> <li>Makes observations that are incomplete or lack accuracy.</li> <li>Data analysis is superficial or partially incorrect.</li> <li>Models or explanations are underdeveloped or weakly supported.</li> <li>Proposes weak experiments to test hypotheses.</li> </ul> | <ul style="list-style-type: none"> <li>Fails to identify a clear problem/question.</li> <li>Observations are missing, irrelevant, or incorrect.</li> <li>Data are not analyzed or are misinterpreted.</li> <li>Little to no attempt at developing models or explanations, or explanations are unsupported.</li> <li>Proposes experiments that fail to test hypotheses or fails to propose any feasible experiment.</li> </ul> | Criterion not evaluated in this context. |

Adapted from “Inquiry and Analysis VALUE Rubric” and “Problem Solving VALUE Rubric” by the Association of American Colleges and Universities, 2009, <https://www.aacu.org/value-rubrics>. This derivative work is licensed under CC BY-NC-SA 4.0.