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| **Asking Questions** | **1** | **2** | **3** | **4** |
| * Addressing phenomena or scientific theories | Questions are general and do not reflect scientific thinking. | Questions address phenomena in general rather than specific terms. | Students formulate specific questions based on examining models, phenomena, or theories but students’ questions are not empirically testable. | Students formulate specific questions based on examining models, phenomena, or theories and students’ questions are empirically testable |
| **Evaluating Questions** | **1** | **2** | **3** | **4** |
| * Evaluating questions concerning phenomena or scientific theories. | Students show no indication of evaluation of questions in terms of relevance or targeted phenomena. | Students attempt to evaluate questions in terms of relevance or targeted phenomena but demonstrate limited or ineffective completion of the task. | Students evaluate questions in terms of whether or not answers to the questions would provide relevant information about the targeted phenomenon in a given context. | Students evaluate questions in terms of whether or not answers to the questions would provide relevant information about the targeted phenomenon in a given context and students’ evaluations of the questions include a description of whether or not answers to the questions would be empirically testable by scientists. |
| * **Defining Problems** | **1** | **2** | **3** | **4** |
| * **Identifying the problem to be solved.** | Student fails to provide a qualitative or quantitative description of the extent or depth of the problem. | Student provides a limited qualitative or quantitative description of the extent and depth of the problem but offer a limited or incorrect rationale as to why it is a global challenge. | Student provides a qualitative and quantitative description of the extent and depth of the problem with a rationale as to why it is a global challenge but do not provide adequate documentation. | Student provides a qualitative and quantitative description of the extent and depth of the problem with a rationale as to why it is a global challenge and includes documented background research from two or more sources including research journals. |
| * **Defining the process or system boundaries, and the components of the process or system.** | Student fails to provide an analysis of the problem and does not identify the major elements and relationships in the system o boundaries. | Students’ analyses includes a limited identification of the physical system in which the problem is embedded, fails to fully describe the major elements and relationships in the system and boundaries. | Students’ analyses include identification of the physical system in which the problem is embedded, but fails to fully describe the major elements and relationships in the system and boundaries and does not fully clarify what is and is not part of the problem and analyses lacks a description of societal needs and wants that are relative to the problem. | Students’ analyses include identification of the physical system in which the problem is embedded, including the major elements and relationships in the system and boundaries so as to clarify what is and is not part of the problem and analyses include a description of societal needs and wants that are relative to the problem. |
| * Defining Criteria and Constraints | Student fails to specify the qualitative and quantitative criteria and constraints for a solution to the problem. | Student specifies qualitative or quantitative criteria but does not address constraints for a solution to the problem. | Student specifies the qualitative or quantitative criteria and constraints for acceptable solutions to the problem. | Students specify the qualitative and quantitative criteria and constraints for acceptable solutions to the problem. |