

## ASET Science & Engineering Practice (SEP) Tool: Constructing Explanations



Name or ID:

Science Lesson/Unit Title:

Intended grade:

|              |   |
|--------------|---|
| <b>SEP 6</b> | <p><b>Constructing Explanations and Designing Solutions:</b> The end-products of science are <b>explanations</b> of natural phenomena and the end-products of engineering are solutions to design problems.</p> <p><b>a. Constructing Explanations:</b> The goal of science is the construction of theories that provide explanatory accounts of the world. A theory becomes accepted when it has multiple lines of empirical evidence and greater explanatory power than previous theories.</p> <p><b>b. Designing Solutions:</b> The goal of engineering design is to find a solution to problems that is based on scientific knowledge and models of the material world. During the design process models or prototypes are systematically tested, and iteratively revised based on performance. Each proposed solution results from a process of balancing competing criteria of desired functions, technical feasibility, cost, safety, aesthetics, and compliance with legal requirements. The optimal choice depends on how well the proposed solutions meet criteria and constraints.</p> |
|--------------|---|

### SEP 6a. Constructing Explanations

| <b>Components of SEP</b><br>In this lesson/unit plan, it is clear that <i>students</i> have a structured opportunity to:  | Mark with "x" if present in lesson | What teacher actions were taken to facilitate this component for students? | What are the students doing? | How is this component reflected in your research/laboratory experience? |
|---|------------------------------------|--|------------------------------|---|
| 1) <b>Articulate</b> a <b>claim/explanation</b> (a testable statement or conclusion that answers a question about how or why) that is based on and consistent with available evidence |                                    |  |                              |   |
| 2) <b>Identify</b> and <b>describe</b> appropriate and sufficient <b>evidence</b> that support the claim/explanation  |                                    |  |                              |   |
| 3) <b>Describe</b> the <b>reasoning</b> (mechanism of how or why) that connects the evidence to the claim/explanation using scientific ideas/principles                               |                                    |  |                              |   |
| 4) <b>Revise</b> an explanation*  |                                    |  |                              |   |

**Notes on Context/Special Considerations** (part of school year, differentiation, student developmental considerations, etc.):

## ASET Grade Band Criteria (Grade Bands: 6-8, 9-12)

### Science & Engineering Practices

**SEP 6a: Constructing Explanations:** Constructing explanations in 6-8 builds on K-5 experiences and progresses to include constructing explanations supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. In 9-12 they build on K-8 experiences and progress to explanations that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

*By the end of the grade band **students** will have had a structured opportunity to develop an understanding of each of these. Individual lessons or units should include opportunities for **students** to practice one or more of the following components .....*

|  | 6-8 Grade Band   | 9-12 Grade Band   |
|--|--|---|
| 1) <b>Articulate a claim/explanation</b> (a testable statement or conclusion that answers a question about how or why) that is based on and consistent with available evidence | Clearly articulate a claim about (an explanation of) a phenomenon that: <ol style="list-style-type: none"> <li>is a testable statement or conclusion that correctly answers a question about how or why</li> <li>relates the given phenomenon to a relevant scientific idea</li> <li>includes a grade-appropriate level of the mechanism involved</li> <li>is consistent with available evidence</li> <li>includes qualitative or quantitative relationships between variables that predict and/or describe phenomena</li> </ol> | Clearly articulate a claim about (an explanation of) a phenomenon that: <ol style="list-style-type: none"> <li>is a testable statement or conclusion that correctly answers a question about how or why</li> <li>relates the given phenomenon to a relevant scientific idea</li> <li>includes a grade-appropriate level of the mechanism involved</li> <li>is consistent with available evidence</li> <li>include a qualitative <u>and/or</u> quantitative claim regarding the relationship between <u>dependent</u> and <u>independent</u> variables that predict and/or describe phenomena</li> </ol> |
| 2) <b>Identify and describe</b> appropriate and sufficient <b>evidence</b> that support the claim/explanation  | Identify and describe evidence that: <ol style="list-style-type: none"> <li>appropriately and sufficiently support the claim</li> <li>are valid (relevant to phenomena) and reliable (obtained with precision and systematically)</li> <li>are obtained from multiple sources such as the students' own experiments, observations, reading material, numerical data, and/or models or representations</li> </ol>   | Identify and describe evidence that: <ol style="list-style-type: none"> <li>appropriately and sufficiently support the claim</li> <li>are valid (relevant to phenomena) and reliable (obtained with precision and systematically)</li> <li>are obtained from multiple sources such as the students' own experiments, observations, reading material, <u>theories</u>, numerical data, and/or models or representations</li> </ol>   |
| 3) <b>Describe the reasoning</b> (mechanism of how or why) that connects the evidence to the claim/explanation using scientific ideas/principles                               | Describe: <ol style="list-style-type: none"> <li>how or why the evidence support the claim using appropriate scientific ideas/principles</li> <li>the reasoning that connects the evidence to the phenomenon</li> <li>how different pieces of evidence connect to each other (chain of reasoning) to support the explanation</li> <li>why the data or evidence is adequate for the explanation or conclusion</li> </ol>  | Describe: <ol style="list-style-type: none"> <li>how or why the evidence support the claim using appropriate scientific ideas/principles, <u>theories</u>, or <u>models</u></li> <li>the reasoning that connects the evidence to the phenomenon</li> <li>how different pieces of evidence connect to each other (chain of reasoning) to support the explanation</li> <li><u>to what extent</u> the data or evidence and reasoning <u>support the</u> explanation or conclusion</li> <li><u>any possible unanticipated effects</u></li> </ol>  |
| 4) <b>Revise</b> an explanation*   | Given new evidence or context, students apply scientific ideas, principles, and/or evidence to revise an explanation for real- world phenomena, examples, or events  | Given new evidence or context, students apply scientific ideas, principles, and/or evidence to revise an explanation for real- world phenomena, examples, or events   |

\* This component is not required in K-2 or 3-5 grade bands