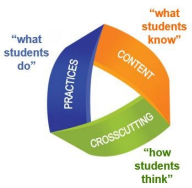


Formats for assessing with the Science & Engineering Practices

Asking Questions

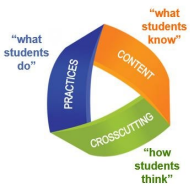
1. Present students with a scenario that describes a phenomenon, then ask students to select from a list of questions to identify which ones can be investigated.
2. Present students with a scenario that describes a phenomenon, then ask students to formulate scientific questions to gather more information or to investigate that phenomenon.
3. Present students with a scenario that describes a phenomenon, then ask students what evidence is needed to answer the question they generated.
4. Present students with a scenario that describes a phenomenon and a scientific question, then ask students to evaluate whether or not the question is relevant to explaining the phenomenon and what evidence is needed to answer the question.
5. Present students with a scenario that describes an investigation of an observable phenomenon, a research question, and a set of data, then ask students to formulate a follow-up question to extend the investigation.
6. Present students with a scenario that describes an investigation of an observable phenomenon, and a research question, then ask students to revise the question to make it investigatable with available resources in the classroom.

Planning and Carrying Out Investigations

1. Present students with a scenario that describes a phenomenon, then ask students to generate a research question to investigate the phenomenon with resources available in the classroom (or a given list of resources), to evaluate different ways of observing or measuring a phenomenon to determine the best answer to the questions asked, to identify the variables, and to make observations/measurements to produce data.
2. Present students with a scenario that describes a phenomenon, a scientific question, and an investigation plan, then ask students to describe how data will be collected precisely, and how much data is needed to be reliable.
3. Present students with a scenario that describes a phenomenon, then ask students to create an investigation plan to study the phenomenon that includes independent and dependent variables and controls, what tools will be used to gather data, how observations/measurements will be recorded, how the investigation will generate relevant evidence for answering the scientific question, and to conduct the investigation and collect data to serve as evidence to answer the scientific question.
4. Present students with a scenario that describes a phenomenon and an investigation plan, then ask students to consider possible confounding variables or effects and evaluate the investigation's design to ensure it will produce the necessary data, to revise the investigation to ensure it will produce the necessary data, and to conduct the investigation and write an explanation to answer the scientific question using the data from the investigation as evidence.

Obtaining, Evaluating, and Communicating Information

1. Present with a scenario that describes a phenomenon and includes a set of resources (texts, data displays, equations, models, etc.), then ask students to synthesize information from the resources, compare and



Formats for assessing with the Science & Engineering Practices

contrast information from the resources to determine which are most relevant, and communicate information from the resources with others (written, oral, or drawing of a model).

2 Present with a scenario that describes a phenomenon and includes a set of resources (texts, data displays, equations, models, etc.), then ask students to integrate information across the resources in order to explain, clarify, or ask questions about the claims made in the resources.

3 Present students with a set of scientific literature, then ask students to analyze and write about the validity of the information in the text.

4 Present students with a scenario that describes a phenomenon or an investigation of a phenomenon, then ask students to use multiple ways of presenting information (e.g., graphically, mathematically) to communicate about the phenomenon to a given audience or an audience of their choosing.

Designing Solutions (Engineering)

1 Present students with a scenario that describes a problem with descriptions of the needs or concerns to be addressed, design criteria, and design constraints, then ask students to sketch or describe a design approach that develops a possible solution to the problem and explain how the relevant scientific ideas are taken into account within their design.

2 Present students with a scenario that describes a problem with descriptions of the needs or concerns to be addressed, design criteria, and design constraints, then ask students to sketch, prototype, or describe a design that is a possible solution to the problem using relevant materials and construct a prototype of their design.

3 Present students with a description of a designed system and data from a failure scenario (one that did not completely meet criteria for solutions), then ask students to analyze the data, identify the scientific cause of the failure, and ask them to sketch or describe a design iteration that might be an improvement to the design.

4 Present students with a description of two compelling solutions to well-defined problems given a set of described needs, criteria, and constraints, along with evidence related to the performance of each solution, then ask students to evaluate which design better addresses the needs, evaluate which design meets the criteria and constraints, and justify their conclusion using evidence.

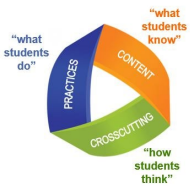
5 Present students with a scenario that describes a complex real-world problem, then ask students to design a solution that is based on scientific knowledge, prioritized criteria, and student-generated sources of evidence.

Developing and Using Models

1 Present students with a scenario that describes a phenomenon, then ask students to develop a model that represents amounts, relationships, scales, or patterns in the natural world, or a model based on evidence from the scenario to represent an object or tool.

2 Present students with a scenario that describes a phenomenon and with two different models for that phenomenon, then ask students to compare the two models to identify the common features and differences and to revise one of the models to justify their revisions.

3 Present students with a phenomenon and a question or problem related to the phenomenon, then ask students to develop a model with components that answers the question or demonstrates a solution, and to write an



Formats for assessing with the Science & Engineering Practices

explanation for the phenomenon or problem using the model as evidence.

4 Present students with a scenario that describes a phenomenon and a question or problem related to the phenomenon, then ask students to develop a model that generates data and to write an explanation or explain a solution using data generated from the model.

5 Present students with a scenario that describes a phenomenon and a question or problem related to the phenomenon, then ask students to develop two types of models and to write an explanation to explain a solution using evidence generated from more than one type of model.

6 Present students with a scenario that describes a phenomenon and a model to describe or predict something related to the phenomenon, then ask students to develop a test to understand the reliability of the model and revise the model to improve its reliability.

Using Mathematics and Computational Thinking

1 Present students with a phenomenon and data in the form of measured quantities, then ask students to describe patterns in the data using counting and numbers, to construct a display of the data using simple graphs, and to describe the patterns and relationships from the representation and written description.

2 Present students with a scenario that includes a dataset from an investigation, the question the investigation is intended to answer, then ask students to identify mathematical properties of the dataset (e.g., range, average) that should be analyzed to answer the question.

3 Present students with a scenario that describes a phenomenon and data in the form of measured quantities, then ask students to develop an equation that corresponds to the description, and explain how the equation represents the textual description.

4 Present students with a simulation of a phenomenon, then ask students to compare the simulation results with real-world data analyzed using mathematics, and write an argument for whether or not the simulation makes sense using the comparison as supporting evidence.

Analyzing and Interpreting Data

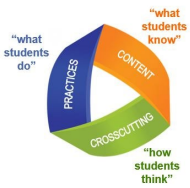
1 Describe an engineering design problem, a solution to the problem, and a set of data from a test of the solution, then ask students to evaluate which design solution best addresses the problem and constraints.

2 Present students with a scenario that describes a phenomenon, and one or more recorded observations from the investigation directly relevant to explaining the phenomenon, then ask students to make a prediction and compare it to the observation given, to organize the data and describe how this organization helps them explain the phenomenon.

3 Present students with a scenario that describes a phenomenon and multiple recorded observations from the investigation, only some of which are relevant to explaining the phenomenon and ask students to describe which data are relevant to explaining the phenomenon under investigation and to interpret the analysis as evidence for explaining the phenomenon.

4 Describe one or more recorded observations from an investigation, then ask students to organize, represent, and analyze the data in at least two different ways and to compare how the representations and analyses help them to identify patterns in the data.

5 Present students with with a scenario that describes an investigation and one or more recorded observations, then ask students to construct graphical displays of data and identify relationships in data sets, to use statistics to analyze the data (mean, median, mode, variability), to draw conclusions supported by their mathematical



Formats for assessing with the Science & Engineering Practices

analysis, and to describe the limitations in data analysis and in relation to the methods for data collection.

6 Present students with a scenario that describes a hypothesis and a phenomenon under investigation, then ask students with a data set that would support the hypothesis and to say how the pattern of evidence from the data supports the hypothesis.

Constructing Explanations

1 Present students with a question about a phenomenon works and related observations (firsthand or from media sources), then ask students to interpret the observations, to answer the question by producing an explanation (using words or drawings), and give reasons for how the observations support their answer to the question.

2 Describe a phenomenon to students along with some related qualitative or quantitative data/observations, then ask students to produce an explanation about the causal mechanism for the phenomena, and show how their interpretation of the data is evidence for their explanation.

3 Describe a phenomenon to students along with a related set of evidence and an explanation that includes multiple scientific principles, then ask students to say which pieces of evidence support or contradict particular components of the explanation.

4 Present students with data from independent and dependent variables in an investigation, then ask them to construct a (quantitative and/or qualitative) claim about how the independent variables relate to the dependent variables.

Engaging in Argument from Evidence

1 Describe a phenomenon and give two or more competing arguments with varying degrees of evidence then ask students to identify which arguments are more scientific and why.

2 Present students with a claim about a phenomenon, then ask students to identify evidence that supports the claim and explain how the scientific principle connects to the evidence for the claim.

3 Describe a phenomenon to students, then ask students to make a claim about the phenomenon and identify evidence that supports the claim and explain how the scientific principle connects to the evidence for the claim.

4 Describe an engineering design problem, a proposed solution, and a set of data collected during the testing of the solution, then ask students to interpret the data to identify quality scientific evidence and support a claim about how well the solution addresses the problem using evidence.

5 Present students with a claim, a list of data sources that are relevant to the claim, then ask students to identify a pattern of evidence from the data that would support or refute the claim.

6 Describe a scenario in which two or more scientific arguments are offered for a phenomenon, then ask students to evaluate the merits of each argument by analyzing its fit with currently accepted explanations and use their evaluation to draw a conclusion about which argument is better supported.