NECAP
Science Assessment

Guidelines for the Development of Science Inquiry Tasks

Created in Partnership by the New Hampshire, Rhode Island, and Vermont Departments of Education

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Introduction: Inquiry in the NECAP Science Assessment

Defining the NECAP Science Assessment Inquiry Task

Focus – The Science Inquiry Task at every grade level should be rich and engaging. The task may be an experimental question or observational question – it is the quality of the task that is most important. Regardless of the type of task, all Four Broad Areas of Inquiry as defined in the *NECAP Schema for Assessing Scientific Inquiry*, (see column headings in the table on page 4), will be assessed. The task should flow from beginning to end in a purposeful way that allows students to make connections, express their ideas, and provide evidence of scientific thinking.

Design – Inquiry Tasks should be rooted in one or more NECAP Science Assessment Targets (one of which should have INQ code) and over time should address a variety of content domains. For every task at grades four and eight there must be scoreable components from each of the Four Broad Areas of Inquiry. At grade 11, while the focus of the task may be on constructs in the Area of Developing and Evaluating Explanations (column 4), scoreable items from each of the other three Broad Areas of Inquiry should also be included.

Task development will be guided by *Guidelines for the Development of Science Inquiry Tasks* (*GDIT*). For each item within a Science Inquiry Task, the developer must identify the Depth of Knowledge (DOK), the Inquiry Construct number, score points, and key elements (scoring notes). Over time, all Inquiry Constructs should be addressed at each grade level. See the Appendix for additional information about the Inquiry Task development process.

Goal – Science Inquiry Tasks will engage students in a range of Depth of Knowledge experiences up to and including strategic thinking (DOK 3). Individual tasks may look different, but each should focus on providing insight into how students engage in scientific thinking. The goal is to encourage the meaningful inclusion of inquiry in classrooms at all levels.

Applying the Guidelines of the Science NECAP Assessment Task in the Classroom

Background – The first version of *Guidelines for Development of Science Inquiry Tasks* was originally created by the Science Specialists from the New Hampshire, Rhode Island, and Vermont Departments of Education to facilitate and refine the development of Inquiry Tasks for the NECAP Science Assessment. It became clear that such a tool would be useful to teachers and local science specialists to guide them in the development of similar tasks for classroom use at all levels. The State Science Specialists have collaborated on this version of *GDIT* to help educators understand and employ the constructs of the Four Broad Areas of Inquiry as they design or evaluate inquiry tasks for classroom instruction and assessment.

Focus - Classroom inquiry tasks should be relevant, engaging and meaningful learning experiences for students. The classroom inquiry tasks included on the state Department of Education website are examples of the kinds of tasks found in the NECAP Science Assessment. In the classroom any inquiry activity should provide regular opportunities for students to experience the science process as defined in the *NECAP Schema for Assessing Scientific Inquiry* (see page 4). Analysis of student performance on classroom inquiry tasks can inform instruction by providing data on student proficiencies within the constructs across the Four Broad Areas of Inquiry. Classroom inquiry tasks might be used as a component of local assessment or as a classroom summative assessment for a specific unit.

Design - While there are many ways to design inquiry experiences and an assessment for the classroom, *GDIT* provides a framework for the development of rich performance assessments that are aligned with this component of the NECAP Science Assessment. *GDIT* offers the necessary details for teachers to develop classroom inquiry tasks that are similar in structure to the NECAP Science Inquiry Tasks. Each classroom inquiry task will include elements from each of the Four Broad Areas of Inquiry, and address specific constructs within each Broad Area. Classroom inquiry tasks can span a class period, a few days or the length of a unit. Classroom inquiry tasks related to units of study provide opportunities for students to become familiar with the format of the NECAP Science Inquiry Tasks and will help to prepare them for the state assessment

Goals - The main goals of *Guidelines for Development of Science Inquiry Tasks* are to help educators:

- encourage the inclusion of engaging and relevant inquiry experiences in classrooms that contribute to increasing the science literacy of the citizens of New Hampshire, Rhode Island and Vermont;

- develop, evaluate and implement rich science tasks that allow students to gain skills across the Four Broad Areas of Inquiry;

- understand the process and parameters used in the development of Inquiry Tasks for the NECAP Science Assessment;

- provide opportunities for students to become familiar with the format and requirements of the NECAP Science Inquiry Tasks.

NECAP Science Inquiry Constructs for all Grade Levels

NECAP Science Schema for Assessing Scientific Inquiry (with DOK levels for constructs)				
Broad Areas of Inquiry to be Assessed	**Formulating Questions & Hypothesizing**	**Planning and Critiquing of Investigations**	**Conducting Investigations**	**Developing and Evaluating Explanations**
Constructs for each Broad Area of Inquiry (including intended DOK Ceiling Levels, based on Webb Depth of Knowledge Levels for Science – see also Section II) ***Inquiry Constructs answer the question: What is it about the broad area of Inquiry that we want students to know and be able to do?***	**1.** Analyze information from observations, research, or experimental data for the purpose of formulating a question, hypothesis, or prediction: **(DOK 3)** **1a.** Appropriate for answering with scientific investigation **1b.** For answering using scientific knowledge **2.** Construct coherent argument in support of a question, hypothesis, prediction **(DOK 2 or 3 depending on complexity of argument)** **3.** Make and describe observations in order to ask questions, hypothesize, make predictions related to topic **(DOK 2)**	**4.** Identify information/evidence that needs to be collected in order to answer the question, hypothesis, prediction **(DOK 2 – routine; DOK 3 non-routine/ more than one dependant variable)** **5.** Develop an organized and logical approach to investigating the question, including controlling variables **(DOK 2 – routine; DOK 3 non-routine)** **6.** Provide reasoning for appropriateness of materials, tools, procedures, and scale used in the investigation **(DOK 2)**	**7.** Follow procedures for collecting and recording qualitative or quantitative data, using equipment or measurement devices accurately **(DOK 1 – use tools; routine procedure;** DOK 2 – follow multi-step procedures; make observations) **8.** Use accepted methods for organizing, representing, and manipulating data **(DOK 2 – compare data; display data)** **9.** Collect sufficient data to study question, hypothesis, or relationships **(DOK 2 – part of following procedures)** **10.** Summarize results based on data **(DOK 2)**	**11.** Analyze data, including determining if data are relevant, artifact, irrelevant, or anomalous **(DOK 2 – specify relationships between facts; ordering, classifying data)** **12.** Use evidence to support and justify interpretations and conclusions or explain how the evidence refutes the hypothesis **(DOK 3)** **13.** Communicate how scientific knowledge applies to explain results, propose further investigations, or construct and analyze alternative explanations **(DOK 3)**

NECAP Science Assessment Inquiry Task Flow

Administration of each Science Inquiry Performance Task (Grades 4 and 8) should follow the sequence below:

Prior to start of Session 3:

- Set up materials
- Group students

Standard Flow of NECAP Science Inquiry Performance Tasks: (Grades 4 and 8)

1. Directions read aloud by Test Administrator (basic info)
2. Scenario read aloud by Test Administrator (context)
3. Description of the materials and/or model explained by Test Administrator. Students make a prediction individually
4. Students conduct investigation with partner
5. Students clean up kits/experiment with partner
6. Students return to desks with their own Task Booklet to work individually
7. Test Administrator distributes Student Answer Booklets to students
8. Students copy data from Task Booklet to Student Answer Booklet (non-scored)
9. Students answer eight (8) scored questions in Student Answer Booklet

   A. For analyzing the prediction, there will be Yes/No check boxes with space for the narrative below.

   B. At grades 4 and 8, the question where students must graph data will have a hard-coded grid (1/2- inch squares) in the answer box with lines for *x* and *y* axis labels as well as a title. At grade 11, use 1/4- inch squares.

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Standard Flow of NECAP Science Inquiry Data Analysis Tasks: (Grades 8 and 11)

1. Test Administrator distributes Student Answer Booklets to students
2. Directions read aloud by Test Administrator (basic info)
3. Scenario read aloud by Test Administrator (task context)
4. Students answer questions related to the scenario and complete data analysis in the Student Answer Booklet.
5. Items will require high school students to consider the Inquiry Constructs in relation to a selected data set.
6. Upon completion of the task students sit quietly and read until dismissal.

Broad Area 1: Formulating Questions and Hypothesizing

Grade 4

Standard: *Task must provide students a scenario that describes objects, organisms, or events within the environment. The scenario must include information relevant to grade 4 students and sufficient for them to construct questions and/or predictions based upon observations, past experiences, and scientific knowledge.*

Note: *bullets addressing constructs are not all inclusive.*

Inquiry Construct:	**Items addressing this construct require students to:**
1. Analyze information from observations, research, or experimental data for the purpose of formulating a question, hypothesis, or prediction: **1a.** Appropriate for answering with scientific investigation **1b.** For answering using scientific knowledge **DOK 3**	• analyze scientific data and use that information to generate a testable question or a prediction that includes a cause and effect relationship; • generate a question or prediction which is reasonable in terms of available evidence; • support a question or prediction with an explanation. **Note:** Addressing this construct may appear at the beginning of the task, the end, or both.
2. Construct coherent argument in support of a question, hypothesis, prediction **DOK 2 or 3** depending on complexity of argument	• identify evidence that supports or does not support a question or prediction.
3. Make and describe observations in order to ask questions, hypothesize, make predictions related to topic **DOK 2**	• connect observations to a question or prediction. **Note:** Items may refer to an existing, new, or student-generated question or prediction.

Broad Area 2: Planning and Critiquing of Investigations

Grade 4

Standard: *Task requires students to plan or analyze a simple experiment based upon questions or predictions derived from the scenario. The experiment and related items should emphasize fairness in its design.*

Note: The words "procedure" and "plan" are synonymous.

Inquiry Construct:	**Items addressing this construct require students to:**
4. Identify information and/or evidence that needs to be collected in order to answer the question, hypothesis, prediction **DOK 2** (routine) **DOK 3** (non-routine or more than one dependant variable)	• identify the types of evidence that should be gathered to answer the question; • design an appropriate format, such as data tables or charts, for recording data. **Note:** These items could appear at the end of the task.
5. Develop an organized and logical approach to investigating the question, including controlling variables **DOK 2** (routine) **DOK 3** (non-routine)	• develop a procedure to gather sufficient evidence (including multiple trials) to answer the question or test the prediction; • develop a procedure that lists steps logically and sequentially; • develop a procedure that changes one variable at a time. **Note:** These items could appear at the end of the task. Use of the term "variable" should not appear in the item stem.
6. Provide reasoning for appropriateness of materials, tools, procedures, and scale used in the investigation **DOK 2**	• explain why the materials, tools, or procedure for the task are or are not appropriate for the investigation.

Broad Area 3: Conducting Investigations

Grade 4

Standard: *The procedure requires the student to demonstrate simple skills (observing, measuring, basic skills involving fine motor movement). The investigation requires the student to use simple scientific equipment (rulers, scales, thermometers) to extend their senses. The procedure provides the student with an opportunity to collect sufficient data to investigate the question, prediction, or relationships. Student is required to organize and represent qualitative or quantitative data using blank graph/chart templates. Student is required to summarize data.*

Note: Metric measurements are used for Grade 4, except for those pertaining to weather.

Note: Multiple trials mean repeating the experiment to collect multiple sets of data.

Inquiry Construct	Items addressing this construct require students to:
7. Follow procedures for collecting and recording qualitative or quantitative data, using equipment or measurement devices accurately **DOK 1:** use tools; routine procedure; **DOK 2:** follow multi-step procedures; make observations	• record precise data and observations that are consistent with the procedure of the investigation; • include appropriate units of all measurements; • use appropriate measurement tools correctly to collect data; • record and label relevant details within a scientific drawing or diagram.
8. Use accepted methods for organizing, representing, and manipulating data **DOK 2:** compare data; display data	• represent data accurately in a graph/table/chart; • include titles , labels, keys or symbols as needed; • select a scale appropriate for the range of data to be plotted; • use common terminology to label representations; • identify relationships among variables based upon evidence.
9. Collect sufficient data to study question, hypothesis, or relationships **DOK 2** part of following procedures	• show understanding of the value of multiple trials; • relate data to original question and prediction; • determine if the quantity of data is sufficient to answer the question or support or refute the prediction.
10. Summarize results based on data **DOK 2**	• consider all data when developing an explanation and/or conclusion; • identify patterns and trends in data.

Broad Area 4: Developing and Evaluating Explanations

Grade 4

Standard: *Task must provide the opportunity for students to use data to construct an explanation based on their science knowledge and evidence from experimentation or investigation.*

Inquiry Construct	Items addressing this construct require students to:
11. Analyze data, including determining if data are relevant, artifact, irrelevant, or anomalous **DOK 2 -** specify relationships between facts; ordering, classifying data	• identify data relevant to the task or question ; • identify factors that may affect experimental results (e.g. variables, experimental error, environmental conditions); • classify data into meaningful categories.
12. Use evidence to support and justify interpretations and conclusions or explain how the evidence refutes the hypothesis **DOK 3**	• identify data that seem inconsistent ; • use evidence to support or refute a prediction; • use evidence to justify an interpretation of data or trends; • identify and explain differences or similarities between prediction and experimental data; • provide a reasonable explanation that accurately reflects data; • use mathematical reasoning to determine or support conclusions.
13. Communicate how scientific knowledge applies to explain results, propose further investigations, or construct and analyze alternative explanations **DOK 3**	• explain how experimental results compare to accepted scientific understanding; • suggest ways to modify the procedure in order to collect sufficient data; • identify additional data that would strengthen an investigation; • connect the investigation or model to a real world example; • propose new questions, predictions, next steps or technology for further investigations; • design an investigation to further test a prediction.

Broad Area 1: Formulating Questions and Hypothesizing

Grade 8

Standard: *Task must provide students a scenario that describes objects, organisms, or events to which the student will respond. The task will provide the student with the opportunity to develop their own testable questions or predictions based upon their experimental data, observations, and scientific knowledge. The task could include opportunities for the student to refine and refocus questions or hypotheses related to the scenario using their scientific knowledge and information*

Inquiry Construct	Items addressing this construct require students to:
1. Analyze information from observations, research, or experimental data for the purpose of formulating a question, hypothesis, or prediction: **(DOK 3)** **1a.** Appropriate for answering with scientific investigation **1b.** For answering using scientific knowledge	• analyze scientific data and use that information to generate a testable question or a prediction that includes a cause and effect relationship; • generate a question or a prediction which is reasonable in terms of available evidence; • support their question or prediction with a scientific explanation; • refine or refocus a question or hypothesis using experimental data, research, or scientific knowledge. **Note:** Addressing this construct may appear at the beginning of the task, the end, or both.
2. Construct coherent argument in support of a question, hypothesis, prediction **DOK 2 or 3** depending on complexity of argument	• identify evidence that supports or does not support a question, hypothesis or prediction; • explain the cause and effect relationship within the hypothesis or prediction; • use a logical argument to explain how the hypothesis or prediction is connected to a scientific concept, or observation.
3. Make and describe observations in order to ask questions, hypothesize, make predictions related to topic **DOK 2**	• connect observations to a question or prediction. **Note:** Items may refer to an existing, new, or student-generated question or prediction.

Broad Area 2: Planning and Critiquing of Investigations

Grade 8

Standard: *The task will require students to plan or analyze an experiment or investigation based upon questions, hypothesis, or predictions derived from the scenario. An experiment must provide students with the opportunity to identify and control variables. The task will provide opportunities for students to think critically about experiments and investigations and may ask students to propose alternatives.*

Note: Scale refers to proportionality between the model and what it represents or the frequency with which data are collected.

Inquiry Construct	***Items addressing this construct require students to:***
4. Identify information/evidence that needs to be collected in order to answer the question, hypothesis, prediction **DOK 2:** routine; **DOK 3:** non-routine/ more than one dependant variable	• identify the types of evidence that should be gathered to answer the question, or support or refute the prediction ; • identify the variables that may affect the outcome of the experiment or investigation; • design an appropriate format for recording data; • evaluate multiple data sets to determine which data are relevant to the question, hypothesis or prediction. **Note:** These items could appear at the end of the task
5. Develop an organized and logical approach to investigating the question, including controlling variables **DOK 2**: routine (replicates existing procedure); **DOK 3:** non-routine (extends, refines, or improves existing procedure)	• develop a procedure to gather sufficient evidence (including multiple trials) to answer the question, or test the hypothesis, or prediction; • develop a procedure that lists steps sequentially and logically; • explain which variable will be manipulated or changed (independent) and which variable will be affected by those changes (dependent); • identify variables that will be kept constant throughout the investigation; • use scientific terminology that supports the identified procedures; • evaluate the organization and logical approach of a given procedure including variables, controls, materials, and tools; • evaluate investigation design, including opportunities to collect appropriate and sufficient data. **Note:** These items could appear at the beginning or the end of the task.
6. Provide reasoning for appropriateness of materials, tools, procedures, and scale used in the investigation **DOK 2**	• explain why the materials, tools, procedure, or scale for a task are appropriate or are inappropriate for the investigation. • evaluate the investigation for the safe and ethical considerations of the materials, tools, and procedures.

Broad Area 3: Conducting Investigations

Grade 8

Standard: *The procedure requires the student to demonstrate skills (observing, measuring, basic skills involving fine motor movement) and mathematical understanding. The materials involved in the investigation are authentic to the task required. The procedure provides the student with an opportunity to collect sufficient data to investigate the question, prediction/hypothesis, or relationships. Student is required to organize and represent qualitative or quantitative data. Student is required to summarize data to form a logical argument.* **Note:** Metric units are used for all Grade 8 measurements. **Note:** Multiple trials means repeating the experiment to collect multiple sets of data.	
Inquiry Construct	**Items addressing this construct require students to:**
7. Follow procedures for collecting and recording qualitative or quantitative data, using equipment or measurement devices accurately **DOK 1:** use tools; routine procedure; **DOK 2:** follow multi-step procedures; make observations	• record precise data and observations that are consistent with the procedure of the investigation; • include appropriate units of all measurements; • use appropriate measurement tools correctly to collect data; • record and label relevant details within a scientific drawing.
8. Use accepted methods for organizing, representing, and manipulating data **DOK 2:** compare data; display data	• represent data accurately in an appropriate graph/table/chart; • include titles, labels, keys or symbols as needed; • select a scale appropriate for the range of data to be plotted; • use scientific terminology to label representations; • identify relationships among variables based upon evidence. **Note:** The standard practice of graphing in science is to represent the independent on the *x*-axis and the dependent variable on the *y*- axis.
9. Collect sufficient data to study question, hypothesis, or relationships **DOK 2**: part of following procedures	• show understanding of the value of multiple trials; • relate data to original question, hypothesis or prediction; • determine if the quantity of data is sufficient to answer the question or support or refute the hypothesis or prediction.
10. Summarize results based on data **DOK 2**	• consider all data when developing an explanation/conclusion; • identify patterns and trends in data.

Broad Area 4: Developing and Evaluating Explanations

Grade 8

Standard *Task must provide the opportunity for students to use data to construct an explanation based on their science knowledge and evidence from experimentation or investigation. The task requires students to use qualitative and quantitative data to communicate conclusions and support/refute prediction/hypothesis.*	
Inquiry Construct	**Items addressing this construct require students to:**
11. Analyze data, including determining if data are relevant, artifact, irrelevant, or anomalous **DOK 2:** specify relationships between facts; ordering, classifying data	• identify data relevant to the task or question; • identify factors that may affect experimental results (e.g. variables, experimental error, environmental conditions); • classify data into meaningful categories; • compare experimental data to accepted scientific data provided as part of the task; • use mathematical and statistical techniques to analyze data; • provide a reasonable explanation that accurately reflects data; • use content understanding to question data that might seem inaccurate; • evaluate the significance of experimental data.
12. Use evidence to support and justify interpretations and conclusions or explain how the evidence refutes the hypothesis **DOK 3**	• identify and explain data, interpretations or conclusions that seem inaccurate; • use evidence to support or refute question or hypothesis; • use evidence to justify an interpretation of data or trends; • identify and explain differences or similarities between predictions and experimental data; • provide a reasonable explanation that accurately reflects data; • use mathematical computations to determine or support conclusions.
13. Communicate how scientific knowledge applies to explain results, propose further investigations, or construct and analyze alternative explanations **DOK 3**	• explain how experimental results compare to accepted scientific understanding; • recommend changes to procedures to produce data that would provide sufficient data and more accurate analysis; • identify and justify additional data that would strengthen an investigation; • connect the investigation or model to an authentic situation; • propose and evaluate new questions, predictions, next steps or technology for further investigations or alternative explanations; • account for limitations and/or sources of error within the experimental design; • apply experimental results to a new problem or situation.

Broad Area 1: Formulating Questions and Hypothesizing

Grade 11

***Standard**: Task must provide students a scenario with information and detail sufficient for the student to create a testable prediction or hypothesis. Students will draw upon their science knowledge base to advance a prediction or hypothesis using appropriate procedures and controls; this may include an experimental design.*

Inquiry Construct	Items addressing this construct require students to:
1. Analyze information from observations, research, or experimental data for the purpose of formulating a question, hypothesis, or prediction. **1a.** Appropriate for answering with scientific investigation **1b.** For answering using scientific knowledge **DOK 3**	• analyze scientific data and use that information to generate a testable question, hypothesis, or prediction that includes a cause and effect relationship; • generate a question, hypothesis or a prediction which is reasonable in terms of available evidence; • show connections between hypothesis or prediction and scientific knowledge, observations, or research; • support their question, hypothesis, or prediction with a scientific explanation; • refine or refocus a question or hypothesis using experimental data, research, or scientific knowledge. **Note:** Addressing this construct may appear at the beginning of the task, the end, or both.
2. Construct coherent argument in support of a question, hypothesis, prediction. **DOK 2 or 3:** depends on complexity of argument	• identify evidence that supports or does not support a question, hypothesis or prediction • explain the cause and effect relationship within the hypothesis or prediction; • use a logical argument to support the hypothesis or prediction using scientific concepts, principles, or observations.
3. Make and describe observations in order to ask questions, hypothesize, make predictions related to topic. **DOK 2**	• connect observations and data to a question, hypothesis, or prediction. **Note:** Items may refer to an existing, new, or student-generated question, hypothesis, or prediction.

Broad Area 2: Planning and Critiquing of Investigations

Grade 11

Standard: *The task will require students to plan or analyze an experiment or investigation based upon questions, hypothesis, or predictions derived from the scenario. An experiment must provide students with the opportunity to identify and control variables. The task will provide opportunities for students to think critically and construct an argument about experiments and investigations and may ask students to propose alternatives. Task will require the student to identify and justify the appropriate use of tools, equipment, materials, and procedures involved in the experiment.* **Note:** Scale refers to proportionality between the model and what it represents or the frequency with which data are collected.	
Inquiry Construct	**Items addressing this construct require students to:**
4. Identify information/evidence that needs to be collected in order to answer the question, hypothesis, prediction **DOK 2:** routine; **DOK 3:** non-routine; more than one dependent variable	• identify the types of evidence that should be gathered to answer the question, or support or refute the hypothesis or prediction; • identify the variables that may affect the outcome of the experiment or investigation; • design an appropriate format for recording data and include relevant technology; • evaluate multiple data sets to determine which data are relevant to the question, hypothesis or prediction. **Note:** These items could appear at the end of the task.
5. Develop an organized and logical approach to investigating the question, including controlling variables **DOK 2**: routine (replicates existing procedure); **DOK 3:** non-routine (extends, refines, or improves existing procedure)	• develop a procedure to gather sufficient evidence (including multiple trials) to answer the question, or test the hypothesis, or prediction; • develop a procedure that lists steps sequentially and logically and incorporates the use of appropriate technology; • explain which variable will be manipulated or changed (independent) and which variable will be affected by those changes (dependent); • identify variables that will be kept constant throughout the investigation; • distinguish between the control group and the experimental group in an investigation; • use scientific terminology that supports the identified procedures; • evaluate the organization and logical approach of a given procedure including variables, controls, materials, and tools. • evaluate investigation design, including opportunities to collect appropriate and sufficient data. **Note:** These items could appear at the beginning or the end of the task.

6. Provide reasoning for appropriateness of materials, tools, procedures, and scale used in the investigation **DOK 2**	• explain why the materials, tools, procedure, or scale for a task are appropriate or inappropriate for the investigation. • evaluate the investigation for the safe and ethical considerations of the materials, tools, and procedures.

Broad Area 3: Conducting Investigations

Grade 11

Standard: *The procedure requires the student to collect data through observation, inference, and prior scientific knowledge. Mathematics is required for the student to determine and report data. The task scenario is authentic to the realm of the student. The task requires the student to collect sufficient data to investigate the question, prediction/hypothesis, or relationships. Student is required to organize and represent qualitative or quantitative data. Student is required to summarize data to form a logical argument.* **Note:** Metric units are used for all Grade 11 measurements **Note:** Multiple trials mean repeating the experiment to collect multiple sets of data.	
Inquiry Construct	**Items addressing this construct require students to:**
7. Follow procedures for collecting and recording qualitative or quantitative data, using equipment or measurement devices accurately **DOK 1:** use tools; routine procedure; **DOK 2**: follow multi-step procedures; make observations	• record precise data and observations that are consistent with the procedure of the investigation; • include appropriate units of all measurements; • use appropriate measurement tools correctly to collect data; record and label relevant details within a scientific drawing.
8. Use accepted methods for organizing, representing, and manipulating data **DOK 2** : compare data; display data	• represent data accurately in an appropriate graph/table/chart; • include titles, labels, keys or symbols as needed; • select a scale appropriate for the range of data to be plotted; • use scientific terminology to label representations; • identify relationships among variables based upon evidence. **Note:** The standard practice of graphing in science is to represent the independent on the *x*-axis and the dependent variable on the *y*- axis.
9. Collect sufficient data to study question, hypothesis, or relationships **DOK 2** : part of following procedures	• show understanding of the value of multiple trials • relate data to original question, hypothesis or prediction; • determine if the quantity of data is sufficient to answer the question or support or refute the hypothesis or prediction.
10. Summarize results based on data **DOK 2**	• consider all data when developing an explanation/conclusion; • identify patterns and trends in data.

Broad Area 4: Developing and Evaluating Explanations

Grade 11

Standard: *Task must provide the opportunity for students to use data to construct an explanation based on their science knowledge and evidence from experiment or investigation. The task requires students to use qualitative and quantitative data to communicate conclusions and support/refute prediction/hypothesis. The task provides students the opportunity to recognize and analyze alternative methods and models to evaluate other plausible explanations.* ***Note:*** *The complexity of the scenario and associated data sets distinguishes this task from an 8th Grade task.*	
Inquiry Construct	**Items addressing this construct require students to:**
11. Analyze data, including determining if data are relevant, artifact, irrelevant, or anomalous **DOK 2**: specify relationships between facts; ordering, classifying data	• identify data relevant to the task or question; • identify factors that may affect experimental results (e.g. variables, experimental error, environmental conditions); • analyze data and sort into meaningful categories; • compare experimental data to accepted scientific data provided as part of the task; • use mathematical and statistical techniques to analyze data; • provide a reasonable explanation that accurately reflects data; • use content understanding to question data that might seem inaccurate • evaluate the significance of experimental data.
12. Use evidence to support and justify interpretations and conclusions or explain how the evidence refutes the hypothesis **DOK 3**	• identify and explain data, interpretations or conclusions that seem inaccurate; • use evidence to support or refute question or hypothesis; • use evidence to justify an interpretation of data or trend; • identify and explain differences or similarities between hypothesis and predictions and experimental data; • use evidence to justify a conclusion or explanation based on experimental data; • use mathematical computations to determine or support conclusions; • evaluate potential bias in the interpretation of evidence.

13. Communicate how scientific knowledge applies to explain results, propose further investigations, or construct and analyze alternative explanations **DOK 3**	• explain how experimental results compare to accepted scientific understanding; • recommend changes to procedures to produce data that would provide sufficient data and more accurate analysis; • identify and justify additional data that would strengthen an investigation; • connect the investigation or model to an authentic situation; • propose and evaluate new questions, predictions, next steps or technology for further investigations or alternative explanations; • account for limitations and/or sources of error within the experimental design; • apply experimental results to a new problem or situation; • consider the impact (safety, ethical, social, civic, economic, environmental) of additional investigations.

APPENDIX

NECAP Science
Inquiry Task Development Process

Initial Steps for the Development of an Inquiry Task

1. Identify the NECAP Assessment **TARGET** to be addressed within the major idea for the task.

2. Refer to the ***Guidelines for the Development of Science Inquiry Tasks*** (***GDIT***). Brainstorm constructs that would be addressed under each broad area within the major idea for the task.

Formulating Questions and Hypothesizing	**Planning and Critiquing of Investigations**	**Conducting Investigations**	**Developing and Evaluating Explanation**

3. Develop a draft **SCENARIO** aligned to the major idea of the task that could generate testable questions.*

4. Identify an authentic **Data Set** (Grades 8 & 11) that applies to the **TARGET** and relates to the **SCENARIO** *

OR

Provide opportunity for **Collection of Data** (Grade 4 & 8) that applies to the **TARGET** and relates to the **SCENARIO** *

* **Note**: *The previous steps are interdependent. The construction of the draft SCENARIO and the identification of a data set, will inform one another. Either may necessitate modifications for alignment, as the task items are being developed.*

Components of the Final Inquiry Task

Each **Inquiry Task** must include:

- A cohesive series of scoreable items, totaling 16-18 points, that assess student understanding in each of the four broad areas of inquiry, as described in the ***GDIT***.
- Scoreable items that have sufficient complexity for students to demonstrate scientific thinking related to inquiry.
- An identified DOK level for each scoreable item.
- A scoring rubric for each scoreable item.