## Stage 1: Desired Results

**NJSLS-S: Science Performance Expectations (2013)**

**NJSLS-S: HS Engineering Design**

**Performance Expectations**

- HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

**NJSLS-S: Science and Engineering Practices**

**NJSLS-S: 9-12**

### Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 9-12 builds on K-8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.
- Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.
- Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.
- Ask questions to clarify and refine a model, an explanation, or an engineering problem.
- Evaluate a question to determine if it is testable and relevant.
- Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.
- Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

### Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9-12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

### Practice 7. Engaging in argument from evidence

Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.
- Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence, challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining additional information required to resolve contradictions.

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Access the interactive version of the NGSS [here](#).

### Enduring Understandings

Understand how observations can lead to the formation of testable research questions and hypotheses

### Essential Questions

How can the world around us be used to spark testable research questions?
# Unit 1: Defining Direction

Understand that published research does not supply a complete set of answers

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<td>SMART guidelines for testable questions</td>
<td>Write scientific hypotheses</td>
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<td>Identify the relationship between variables present in scientific writing</td>
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<td>Relationship between dependent and independent variables</td>
<td>Research published literature using online databases</td>
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## Stage 2: Assessment Evidence

### Assessment

**Analyzing Testable Questions**

**Formative: Skills Assessment/Demonstration**
Students will analyze given questions for their testability. They will also be analyzing questions written by their peers in a "gallery walk" style activity.

**Testable Question Proposal**

**Summative: Written Report**
Students will use their research to write a testable question about their topic of interest. The question will be peer reviewed, mentor reviewed, and teacher reviewed prior to a final question is composed to guide future research. This testable question will become a part of their written research proposal at the end of the semester.

**Science Friday Question Brain-dump**

**Diagnostic: Other oral assessments**
After science Friday on the first week of class, students will be asked to present a testable question raised by the article. Students will not be instructed on the qualities of a testable question prior to this activity. As a class we will analyze the question for its testability.

**Written experimental hypothesis**

**Summative: Written Report**
Students will compose their experimental hypothesis based on research and edit the hypothesis based on peer, teacher, and mentor feedback.

**Annotated Bibliography**

**Formative: Other written assessments**
Students will develop an annotated bibliography with at least 6 sources that assist in answering their testable question. In each annotation they will identify the data that is relevant to their own work, the testable question, and hypothesis of the author.

## Stage 3: Learning Plan

**Learning Activities**

Science Friday
Testable Question Gallery Walk
Analyzing the questions
Annotated Bibliography
Development of Individual Research Question
Hypothesis Analysis
Development of Individual Research Hypothesis

**Resources**

SMART question guidelines (from Polar Ice workshop)
Writing a hypothesis:
Polar Ice testable question examples

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Scaffolding and Differentiation

Students will be developing questions based on their own research interests.

Science Fridays will allow students to present research that they find particularly interesting.

All assignments in this class will lead students to developing a research proposal.