Unit 1: Scientific Methods and Measurements

Content Area: **Science**
Course(s):
Time Period:
Length: **10 days**
Status: **Published**

State Mandated Topics Addressed in this Unit

NJSLS-S Performance Expectations:

- **HS-ETS1-2**: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Integrated Mathematics Standards (NJSLS-M):

- **N-Q.A.1**: Use units as a way to understand problems and to guide the solution of multi-step problems.
- **N-Q.A.2**: Define appropriate quantities for the purpose of descriptive modeling.
- **N-Q.A.3**: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Science & Engineering Practices (SEPs):

- SEP 1: Asking Questions and Defining Problems
- SEP 2: Developing and Using Models
- SEP 3: Planning and Carrying Out Investigations
- SEP 4: Analyzing and Interpreting Data
- SEP 5: Using Mathematics and Computational Thinking
- SEP 6: Constructing Explanations and Designing Solutions
- SEP 8: Obtaining, Evaluating, and Communicating Information

Crosscutting Concepts

- Patterns
- Cause and Effect
- Systems and System Models
- Scale, Proportion, and Quantity

These standards support key objectives in the unit including:

- Mastery of metric measurement and conversions

- Use of dimensional analysis
- Differentiation of accuracy vs. precision
- Use of significant figures and scientific notation
- Problem-solving through inquiry-based labs and simulations

Unit Summary

This unit introduces students to the foundational practices of science and engineering. Students will explore the role of science in everyday life and learn how to construct valid experiments using the scientific method. Emphasis will be placed on precision, accuracy, and problem-solving skills through the use of metric measurements, scientific notation, significant figures, and density calculations. Students will also develop fluency in using dimensional analysis to convert between units, fostering quantitative reasoning and real-world application of math and science concepts. These skills lay the groundwork for all subsequent scientific inquiry and align closely with performance expectations related to the engineering design process.

Enduring Understanding

- Dimensional Analysis is a useful tool.
- Measurements are not exact.
- Science explains the natural world.
- Solving problems requires an appreciation of the big picture.

Essential Questions

- How do science and engineering differ in their goals and approaches?
- How do scientists design experiments that produce valid, reliable results?
- How do scientists express the degree of uncertainty in their measurements?
- How do scientists solve problems?
- How do unit conversions and dimensional analysis help solve problems in science and engineering?
- How is dimensional analysis used to solve problems?
- How is the scientific method used to investigate real-world problems?
- How is the scientific method used to investigate real-world problems?
- In what ways is scientific inquiry part of our everyday decision-making?
- What are the roles of significant figures and scientific notation in communicating scientific data?
- When you make a measurement, what are some possible sources of uncertainty?

- Why are accuracy and precision important in scientific measurement?
- Why is it important to study science?
- Why is it important to study so many subjects in school?
- Why is it useful to learn problem solving skills?
- Why is the metric system preferred in scientific work?

Essential Skills

- Analyze and solve real world occurrences using the scientific method.
- Calculate the density of a substance.
- Demonstrate why metric units are easy to use.
- Describe the steps in the scientific method.
- Describe the type of problems that use dimensional analysis
- Evaluate accuracy and precision.
- Evaluate the difference between a scientific law and a theory.
- Explain the process when using a conversion factor.
- Express numbers in scientific notation.
- Explain why the scope of science is so vast.

Standards

SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Objectives

- Analyze and solve real world occurrences using the scientific method.
- Apply significant figures appropriately in multi-step calculations.
- Calculate the density of a substance
- Communicate findings using scientific vocabulary and visual representations.
- Construct and interpret data tables and graphs to support scientific claims.
- Demonstrate why metric units are easy to use
- Describe the steps in the scientific method.
- Describe the type of problems that use dimensional analysis
- Design and critique scientific investigations for reliability and validity.
- Differentiate between qualitative and quantitative data and how each contributes to scientific inquiry.
- Evaluate accuracy and precision
- Evaluate the difference between a scientific law and a theory.
- Explain the process when using a conversion factor

- Express numbers in scientific notation
- Explain why the scope of science is so vast.

Instructional Tasks/Activities

- Common assessment chapter test
- Common assessment quiz
- Constructed response
- Do nows and/or exit slips
- Exit Cards (answer to daily objective questions)
- Graphic organizers or models
- Guided practice
- Homework
- Individual, small, and large group work
- Laboratory investigations within small groups
- Review Activity
- Safety Poster/Presentation (identification of safety rule from student-designed posters)
- Section Review Questions
- Study Guide Packets
- Vocabulary flash cards or map (word, picture, sentence, example)

Assessment Procedure

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly. This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all college prep students.

- Classroom Total Participation Technique
- Classwork
- DBQ
- Essay
- Exit Ticket/Entrance Ticket/Do Now
- Flashcards and/or drill and practice
- Inquiry based activities with reflective discussion
- Journal / Student Reflection
- Kahoot
- Laboratory groups
- Lecture with note taking or guided notes

- Online models and simulators
- Other named in lesson
- Peer Review
- Performance
- Powerpoint presentations
- Problem Correction
- Project
- Quiz
- Rubric
- Teacher Collected Data
- Test
- Whole and small group discussions
- Worksheet

Recommended Technology Activities

- Appropriate Content Specific Online Resource
- Chromebook
- Copy/Paste Content Specific Link Here
- Copy/Paste Content Specific Link Here
- Copy/Paste Content Specific Link Here
- Gimkit
- GoGuardian
- Google Classroom
- Google Docs
- Google Forms
- Google Slides
- Kahoot
- MagicSchool AI
- Other- Specified in Lesson
- Quiziz
- Screencastify

Accommodations & Modifications & Differentiation

Accommodations and Modifications should be used to meet individual needs. Their IEP and 504 plans should be used in addition to the following suggestions.

Gifted and Talented

- Compare & Contrast
- Conferencing
- Debates
- Jigsaw
- Peer Partner Learning
- Problem Solving
- Structured Controversy
- Think, Pair, Share
- Tutorial Groups

Instruction/Materials

- alter format of materials (type/highlight, etc.)
- color code materials
- eliminate answers
- extended time
- extended time
- large print
- modified quiz
- modified test
- Modify Assignments as Needed
- Modify/Repeat/Model directions
- necessary assignments only
- Other (specify in plans)
- other- named in lesson
- provide assistance and cues for transitions
- provide daily assignment list
- read class materials orally
- reduce work load
- shorten assignments
- study guide/outline
- utilize multi-sensory modes to reinforce instruction

Environment

- alter physical room environment
- assign peer tutors/work buddies/note takers
- assign preferential seating

- individualized instruction/small group
- modify student schedule (Describe)
- other- please specify in plans
- provide desktop list/formula

Honors Modifications

Resources

- Resource 1
- Resource 2
- Resource 3
- Resource 4
- Resource 5