Unit 1 Scientific Method & Laboratory Safety

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Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Advanced Physical Science, GRADE 6

Unit 1: Scientific Method & Laboratory Safety

Belleville Board of Education

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Unit Overview

In Unit 1, The Scientific Method and Laboratory Safety, the students are expected to learn:

- how to follow proper scientific sequence
- how to correctly formulate a hypothesis based upon an observation and/or experience
- how to design an experimental procedure, collect evidentiary data, analyze data, and draw upon that data to formulate accurate conclusions
- how to identify variables in a scientific experiment
- how to safely conduct themselves inside of a laboratory
- how to identify laboratory tools and their use

Enduring Understanding

Enduring understandings:

- Students understand core concepts and principles of science and use measurement and observation tools to assist in categorizing, representing, and interpreting the natural and designed world.
- Students master the conceptual, mathematical, physical, and computational tools that need to be applied when constructing and evaluating claims.
- Scientific knowledge builds on itself over time.
- The growth of scientific knowledge involves critique and communication, which are social practices that are governed by a core set of values and norms.
- Scientists use an inquiry process to find answer to questions.

Essential Questions

- What do I need to inquire about?
- Whyis this investifation important?

- What resources are available to help me answer this question?
- How do I colaborate with others?
- How do I communicate my information with others?

Exit Skills

By the end of Grade 6 Physical Science Unit 1, the student should be able to:

- Question for a purpose based on his/her observations.
- Write a formal hypothesis, using the "if..., then..., because" model.
- Identify the independent, dependent, and control variables in an experiment.
- Observe, collect and record data, to detail the results fo an experiment.
- Measure and record accurate data.
- Use appropriate measurement tools, tables, graphs, and charts.
- Present findings in a variety of formats.
- Accept suggestions from peers to improve investigations.

New Jersey Student Learning Standards (NJSLS-S)

6-8.MS-PS2-3.1	Asking questions and defining problems in grades 6–8 builds from grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.
6-8.MS-PS4-2.2	Modeling in 6–8 builds on K–5 and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
6-8.MS-PS1-4.2	Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.
6-8.MS-PS1-1.2	Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.
6-8.MS-PS1-4.2	Cause and effect: Mechanism and explanation.
6-8.MS-PS3-2.2	Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.
6-8.MS-PS2-5.3	Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.
6-8.MS-PS2-2.3	Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.
6-8.MS-PS3-4.3	Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.
6-8.MS-PS1-2.4	Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to

	investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
6-8.MS-PS3-1.4	Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
6-8.MS-PS4-1.5	Mathematical and computational thinking at the 6–8 level builds on K–5 and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.
6-8.MS-PS1-6.6	Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.
6-8.MS-PS3-3.6	Constructing Explanations and Designing Solutions
6-8.MS-PS2-1.6	Constructing Explanations and Designing Solutions
6-8.MS-PS3-5.7	Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed worlds.
6-8.MS-PS2-4.7	Engaging in argument from evidence in 6–8 builds from K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world.
6-8.MS-PS4-3.8	Obtaining, evaluating, and communicating information in 6-8 builds on K-5 and progresses to evaluating the merit and validity of ideas and methods.
6-8.MS-PS1-3.8	Obtaining, evaluating, and communicating information in 6–8 builds on K–5 and progresses to evaluating the merit and validity of ideas and methods.

Interdisciplinary Connections

MA.6.RP.A.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
MA.6.RP.A.2	Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship.
MA.6.RP.A.3	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
MA.6.NS.A.1	Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem.
LA.RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
LA.RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
LA.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
LA.RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.

LA.RST.6-8.5	Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
LA.RST.6-8.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
LA.RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
LA.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
LA.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
LA.WHST.6-8.1	Write arguments focused on discipline-specific content.
MA.6.NS.C.8	Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.
LA.WHST.6-8.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.6-8.4	Produce clear and coherent writing in which the development, organization, voice, and style are appropriate to task, purpose, and audience.
LA.WHST.6-8.5	With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
LA.WHST.6-8.6	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.
LA.WHST.6-8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
LA.WHST.6-8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
LA.WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research.
LA.WHST.6-8.10	Write routinely over extended time frames (time for research, reflection, metacognition/self correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
MA.6.EE.C.9	Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.
MA.6.SP.A.1	Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.
MA.6.SP.B.4	Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
MA.6.SP.B.5	Summarize numerical data sets in relation to their context, such as by:

Learning Objectives

- Develop a scientific problem based upon an observation and /or experience that takes the form of a question and can be

explored through scientific experimentation

- Construct a hypothesis for a scientific problem that consists of an explanation and a rationale for said explanation that is based upon experience and/or observation
- Develop a procedure to test said hypothesis and be able to carry out said procedure in a well-organized, realistic manner
- Identify which variables in your experiment are dependent, independent, and which in the control for your experiment
- Collect and record data by creating and filing in a clear, labeled data table in accordance with said procedure
- Analyze and compare data gathered in a manner to draw accurate conclusions on the scientific problem while identifying any sources of experimental error(s)
- Develop a conclusion that relates to the data collected and is supported by scientific evidence
- Design multiple trials to further test said hypothesis

Suggested Activities

- Work collaboratively in teams to construct a hypothesis to address various questions or problems.
- Identify the independent, dependent, and control variables in various experimental scenario's.
- Conduct "Come Fly with Me" paper airplane experiment, by predicting results, gathering data and reporting results.
- Cut and paste activity to identify the steps of the scientific method.
- Create a poster about Lab Safety

Evidence of Student Learning - Checking for Understanding (CFU)

- Admit Tickets
- Anticipation Guide
- Common benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Newspaper Headline
- Outline
- Question Stems

- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit tests

Primary Resources & Materials

- Defined Stem
- Internet resources
- Science Department video DVD library
- Laboratory materials
- Student Workbooks
- Interactive Notebook

Ancillary Resources

- Guest Speakers
- Additional Internet sources
- Outdoor area of school
- Computer carts for research when available

Technology Infusion

- Smart board
- DefinedStem.com
- Document Camera
- Pod-casts video streams
- Discovery Education video streams
- You Tube video streams
- Brain-pop video streams
- Laptops
- Khan Academy
- Power Point presentation

- MS Word

Alignment to 21st Century Skills & Technology

These skills will be aligned to the following core content areas:

- English Language Arts; reading informational text, following procedural steps, orally presenting predictions and opinions, and creating written laboratory reports
- Mathematics; measuring
- Science and Scientific Inquiry (Next Generation); see above
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics; hisitory of science and how the Scientific method has connections to World and American history expansion. Discuss the inpactof scence on society and what kind of moral questions scientists must address.
- World languages; discussion of root words and linguistic origin of vocabulary words.
- Technology; see above
- Visual and Performing Arts: oral and graphic presentation of procedures, results, and conclusion.

21st Century/Interdisciplinary Themes

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

21st Century Skills

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy

- Life and Career Skills
- Media Literacy

Differentiation

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy - Science Dollars
- Guided Notes
- Teacher reads assessments allowed
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Dictation to scribe

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Multiple texts
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products

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Lo-Prep Differentiations:

- Exploration by interest
- Flexible grouping
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Varied journal prompts
- Correcting summative and formative assessments
- Retaking the test

Intervention Strategies

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Special Education Learning

- printed copy of board work/notes provided

- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multiple test sessions
- multi-sensory presentation
- preferential seating
- preview of content, concepts, and vocabulary
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- Provide native language translation whenever possible
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test

- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

Sample Lesson

Unit Name: Scientific Method, the nature of science

NGSS:
MS-PS1-3 Gather and Make sense of data
MS-PS2-2 Plan an investigation
MS-PS2-3 Ask questions about data
MS-PS3-3 Apply scientific principles

Interdisciplinary Connection:
rst 6.8 1-9
whst 6.8 1-10

Statement of Objective:
Students will be able to distinguish among Indepent Variables, Dependent Variables, Constants, and Controls with in an experiment; Consrtuct a working Hypothesis

Anticipatory Set/Do Now:
What should you do if you data is different from what you expected?

Learning Activity:
Do now activity
"Marble Projectile Lab"
Prep Lab activity, Review the pre lab, and the lab activity
Students work in groups on the the lab activity
Clean up the lab activity to continue tomorrow
*accelerated template will be more in depth and oral discussion will vary

Student Assessment/CFU's:
hand signal, Analogy prompt,Concept map, quiz,Think-pair-share, Oral questioning, 3-2-1, Quick write, Word sort, Take and pass, K-w-l, Newspaper Headline, Gallery Walk

Materials:
Individual worksheets/Guided Notes
Smart board/projector
Document camera
Science Textbook

21st Century Themes and Skills:
Understanding the sceintific method helps students to critical think and problem solve as they learn how to search for anwsers to problems

Differentiation:
To be used where applicable: extend time, read or paraphrase, demonstrate, one on one instruction, positive reinforcement, visual aids, re-phrase written directions, peer learning

Integration of Technology:
Computer displays (power points presentations, video clips) projected by smartboard or project