UNIT OF STUDY

Unit 1

Title: Scientific methodology and measurement Subject/Course: Physical Science Length: 3 weeks

Topic: Safety, scientific method, scientific measurement Grade: 9th Designer: Kathryn Melnick

UNIT GOALS AND EXPECTATIONS

IMPORTANT CONCEPTS/UNDERSTANDINGS:	ESSENTIAL QUESTIONS:
Big Idea: Knowledge of science process skills is necessary for science investigations. The laboratory must be a safe environment for gathering data. Clear communication skills are vital for conveying scientific information. Science quantitative data is reported in SI units. The scientific method is a series of steps for obtaining valid data. Hypotheses are devised according to the effect of the independent variable on the dependent variable. Predictions are made according to patterns previously observed. Mathematics is the language of science. Data may be organized in different ways for better understanding.	What safety rules must be observed in the laboratory? What is the difference between pure and applied science? How are science and technology related? What is the difference between a scientific theory and a general theory? How are a scientific theory and a scientific law related? How do we use the scientific method in science and our everyday lives? How are we biased in our decisions? How can we organize data for better use? What equipment will be used in the laboratory? How do we measure using SI units?

STUDENT LEARNING EXPECTATIONS:	
NS.9.PS.1 Explain why science is limited to natural explanations of how the world works NS.9.PS.2 Compare and contrast hypotheses, theories, and laws NS.9.PS.3 Distinguish between a scientific theory and the term "theory" used in general conversation NS.9.PS.4 Summarize the guidelines of science: -explanations are based on observations, evidence, and testing - hypotheses must be testable -understandings and/or conclusions may change with additional empirical data -scientific knowledge must have peer review and verification before acceptance NS.10.PS.1 Develop and explain the appropriate procedure, controls, and variables (dependent and independent) in scientific experimentation NS.10.PS.2 Research and apply appropriate safety precautions when designing and /or conducting scientific investigations NS.10.PS.3 Identify sources of bias that could affect experimental outcome NS.10.PS.4 Gather and analyze data using appropriate summary statistics NS.10.PS.5 Formulate valid conclusions without bias NS.10.PS.6 Communicate experimental results using appropriate reports, figures, and tables	NS.11.PS.1 Recognize the factors that constitute a scientific theory NS.11.PS.2 Explain why scientific theories may be modified or expanded using additional empirical data, verification, and peer review NS.12.PS.1 Use appropriate equipment and technology as tools for solving problems (e.g., balances, scales, calculators, probes, glassware, burners, computer software and hardware) NS.12.PS.2 Collect and analyze scientific data using appropriate mathematical calculations, figures, and tables NS.12.PS.3 Utilize technology to communicate research findings NS.13.PS.1 Compare and contrast physical science concepts in pure science and applied science NS.13.PS.2 Discuss why scientists should work within ethical parameters NS.13.PS.3 Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology NS.13.PS.5 Describe in detail the methods used by scientists in their research NS.14.PS.1 Research and evaluate physical science careers using the following criteria: -educations requirements -salary -availability of jobs -working conditions

SPECIFIC DECLARATIVE KNOWLEDGE – What I know	SPECIFIC PROCEDURAL KNOWLEDGE – What I need to do
Identify the tools of science. Recall the location of all safety equipment in the lab room. Discuss the safety rules as applied to the laboratory. Explain the difference between scientific hypothesis, theory, and law. Identify whether a question is testable of not. Identify the part of the scientific method from a written paragraph. Identify biases in observations. Determine whether experiments are pure or applied science. Explain the cyclic relationship between science and technology. Prove examples of this relationship. Explain how our knowledge can change with the addition of other information. Record observations in a clear, concise manner. Communicate scientific findings in a manner that is easily understood and in such a manner that an experiment can be replicated by others.	Label a diagram of the safety equipment in the laboratory. Measure length, mass, volume, and temperature to the correct number of significant digits. Perform calculations using correct scientific notation. Measure and convert in SI units. Design and carry out an experiment while identify the parts of the scientific method (controls, constants, independent variable, dependent variable). Place data on correct types of graphs.

UNIT ASSESSMENTS (Include tasks related to Dimensions 3 and 4 and Bloom's Taxonomy)	
Correctly measure the mass to two decimal points. Performance assessment: Illustrate an understanding of appropriate procedures for measuring substances (on balance-subtract mass of dish to find mass of substance, measure temperature of liquids, find the length of a book, etc) Demonstrate an understanding of science processes by designing an experiment. Develop graphs to organize data. Label a drawing of the lab room showing the location of safety equipment. Open response: How can bias affect the outcome of an experiment? Constructed response: Read a story and describe the parts of the scientific method. Open response: How can science influence technology? Writing on safety procedures.	
Traditional Assessments: Test on lab safety procedures Safety quiz. Quiz to identify laboratory equipment. Quiz on elements. Lab skills check up quizzes. Skills sheet on scientific notation. Quiz on metric prefixes Quizzes on metric conversions	Other Evidence of Learning: Lab reports including graphs Line of learning Homework to practice scientific notation Homework on metric conversions

ACTIVITIES AND LEARNING EXPERIENCES	Resources
Safety in the laboratory: The class will take a pretest, watch a safety video, discuss safety rules, tour the lab, take quizzes and do writing to check for comprehension of safety rules, and take a safety test. The students will also take home a safety contract to discuss with their parents and sign.	Pretest Safety video Safety rules Safety contract Safety test
Element quizzes: The students will take weekly quizzes to learn the most commonly used elements and polyatomic ions. These will be cumulative with elements from past weeks	Element list

included randomly each week. Pretest: A pretest for the semester will be given to evaluate the beginning level of the students.	Pretest
Activity: Aluminum in cupric chloride solution. The students will conduct the experiment and record their observations in their notebook. They will complete a writing to 'think about it' in the notebook.	Aluminum, cupric chloride, Beakers,
Activity: What tree is this? Various tree limbs will be used to show the students that we use classification in our everyday lives. This will introduce the concept of the different branches of science. It will also show that science explains 'what is' in nature, science is limited to the natural world….(not love, religion, etc…).	Various tree limbs List of scientific topics to classify into different groups
Activity: Pure vs. Applied science. The students will be given a list of topic to classify into two groups. This will be used to show that some topics are researched as a desire for knowledge while others topics are researched because of a need. Vocabulary sheet will be used for these terms.	List of topics to classify Vocabulary sheets
Activity: How are science and technology related? The class will discuss the cyclic relationship between science and technology. Groups will be given a starting point to work through the cycle of how scientific discoveries give new technology which leads to scientific discoveries. An open response on 'How can science influence technology?' will give the students a change to explain what they have learned.	Topic to start lists Vocabulary sheets
Scientific method: The class will be asked to do a writing at home to give examples of how the scientific method is used in their everyday lives. These will be discussed in class. The difference between a scientific hypothesis and a general hypothesis will be discussed. Vocabulary terms will be: hypothesis, observation, experiment, control, constant, depend variable, independent variable, conclusion, theory, and law. Models will be discussed as a method to explain patterns. Students will discuss ethics and bias in science. They will write on how bias can change the outcome of an experiment.	Vocabulary sheets Models
Activity: The students will be given a list of theories and laws to separate. This will help in their understanding of the difference between laws and theories.	List of topics
Lab equipment: The students will be given various piece of lab equipment which they will need to be able to identify. This will be quizzed on these items. Lab skills: The students will complete lab skills check ups 2 and 3.	Lab equipment Pictures of lab equipment to label and study Quiz Lab books
Lab: How many drops of water will a penny hold? This lab will be used to identify the parts of the scientific method. The students will be dropping water on a penny, wax paper, and then adding soap to the water. The students will write about the parts of the lab, make observations, and draw conclusions.	Pennies Pipettes Wax paper Soap
Lab: How does the swing of one weight affect the swing of another weight? The students will determine their own variables in the experiment. They will label all of the parts of the scientific method in their lab journal.	String, weights
Test on safety and scientific procedures.	Test
Scientific notation: The students will do a pretest on scientific measurement. They will review the rules for writing in and doing calculations with scientific notation. They will practice these skills in class and on homework. They will complete a quiz on these	Pretest Calculators Lab books

problems. Metric units: The students will learn the basis units of the metric system. They will measure mass, volume, and length to the correct number of significant digits in the lab. They will then review the metric prefixes and be quizzed on these. They will convert the measurements taken in the lab to other units. The students will practice these conversions in class and on homework. Graphing: The students will be given data and asked to determine the type of graph needed for each type of data. Graphs will be drawn for a variety of different data. Test: A test will be given over mathematics in the science lab.	Quizzes Practice problems Meter sticks Balances Graduated cylinders Lab books Practice problems Data to graph Different types of graph paper Test
Career Connections	
Forensics scientist	