MAPPING GRADE 7 SCIENCE INSTRUCTION

Concept: Science Process Skills

PWC Objective: LS-1(a) / Infused

The student will utilize experimental methods to plan and conduct investigations. Key concepts include:

- variables are defined **(SOL LS.1b)**
- metric units (SI – International System of Units) are used **(SOL LS.1c)**
- models are constructed to illustrate and explain phenomena **(SOL 1.d)**
- sources of experimental error are identified **(SOL LS 1.e)**
- dependent variables, independent variables, and constants are identified **(SOL LS.1f)**
- variables are controlled to test hypotheses and trials are repeated **(SOL LS.1g)**

What Students Should Know (Critical Attributes)	**What Students Should Be Able To Do** (Essential Skills)
Essential Questions: • What are variables and why is it important to identify, define, and control them? • How can an experimental design help us organize our investigations? • What purpose does a hypothesis serve and how should it be technically stated? • What purpose do models serve? • What is the difference between qualitative and quantitative measurement and what purpose do they serve? **Critical Attributes:** LS.1b Variables are any factor that can influence the outcome of an experiment. Systematic investigations require the identification of the parameter that will deliberately be changed (independent variable) and the response that will be measured due to changes in the independent variable (dependent variable).	• Identify what is deliberately changed in an experiment and what is to be measured as the dependent (responding) variable. • Analyze the variables in an experiment and decide which ones must be held constant (not allowed to change) in order for the investigation to represent a fair test.

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What Students Should Know (Critical Attributes)	**What Students Should Be Able To Do** (Essential Skills)
LS.1c When gathering quantitative data, scientists use the SI or System international (metric system) for uniformity and consistency. Quantitative date is information (data) gathered from counts or measurements using scales having equal sized intervals and a zero value. Such scales are standard scales. Qualitative data are verbal descriptions or information gathered using scales without equal intervals or zero points. Such scales are non-standard scales.	• Select appropriate tools for collecting qualitative and quantitative data and record measurements in metric units (volume, mass, and distance).
LS.1d Models can be helpful in explaining events or sequences of events that occur. They can be used as part of a scientific explanation to support data or represent phenomena, especially those that are not "easy to see" directly and have to be inferred from data. An especially important tool for collecting data in life science is the compound light microscope.	• Create concrete and mental models as ways to visualize explanations of ideas and phenomena.
LS.1e Experimental design is a useful process that includes organizing all components of an investigation in a meaningful way in order to easily identify and levels of the independent variable, the dependent variable (responses measured because of the changes in the independent variable, number of trials, and mathematical means.	
LS.1e An experimental design and the events that occurred in the investigation should be evaluated to determine if mistakes in procedure have been made that might have affected the results.	• Evaluate the design of an experiment and the events that occur during an investigation to determine which factors may affect the results of an experiment. Examine the experimental procedure and decide where or if there were mistakes.
LS.1f Systematic investigations require a hypothesis stated in such a way that it identifies the independent variable (parameter that is deliberately changed) and the dependent variable (the response that can be measured because of changes in the independent variable) and the relationship between them. If the independent variable happens, then the dependent variable should follow: "if (this independent variable happens), then (what dependent variable will follow)?	• Construct hypotheses to predict the relationship between the independent variable and the dependent variable.
LS.1g It is important to control the experiment by conducting trials for the experiment in which the independent variable is not applied. This requires that a standard be established to which experimental results can be compared. In a controlled experiment there is only one independent variable.	• Determine the specific component of an experiment to be changed as an independent variable and control the experiment by conducting trials for the experiment in which the independent variable is <u>not</u> applied. This requires the student to set up a standard to which the experimental results can be compared.

MAPPING GRADE 7 SCIENCE INSTRUCTION

Concept: Science Process Skills

PWC Objective: LS-1(b) / Infused

The student will organize and communicate data and results from systematic investigations. Key concepts include:

- data are organized into tables showing repeated trials and means **(SOL LS.1a)**
- continuous line graphs are constructed, interpreted, and used to make predictions **(SOL LS.1h)**
- interpretations from the same set of data are evaluated and defended **(SOL LS.1i)**
- an understanding of the nature of science is developed and reinforced **(SOL LS.1j)**

What Students Should Know (Critical Attributes)	**What Students Should Be Able To Do** (Essential Skills)
Essential Questions: • What does careful analysis of data allow us to do? • How do researchers present their research findings and what are the components of this format?	
Critical Attributes:	
LS.1a Expected results are reflected in the organization of the data table, which includes an area to record the number of repeated trials, levels of the independent variable, measured results for the dependent variable, and analysis of the results by calculation of the means.	• Design a data table that includes a space to organize all components of an investigation in a meaningful way, including levels of the independent variable, responses measured of the dependent variable, number of trials, and mathematical means.
LS.1h After scientists organize data in tables, they often display the data in graphs. A graph is a diagram that shows a comparison between variables. A line graph is used to show the relationship between two variables. The variables being compared go on two axis of the graph. The independent variable always goes on the horizontal axis, called the x-axis. The dependent variable always goes on the vertical axis or y-axis.	• Construct appropriate graphs using data sets from experiments. • Recognize that a linear graph is most appropriate for reporting continuous or real time data. Comprehend that points along the line that are not actual data points can be used to make predictions.
LS.1i Conclusions should be based on a data set to verify whether the data set truly supports the conclusion. This involves references to the data that specifically support findings and established conclusions.	• Develop conclusions based on a data set and verify whether the data set truly supports the conclusion. • Cite references to the data that specifically support the conclusion.

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What Students Should Know (Critical Attributes)	**What Students Should Be Able To Do** (Essential Skills)
LS.1i It is necessary to devote time and mental energy to carefully study data for relationships and patterns. Careful interpretation of the data allows us to more easily defend our findings.	
LS.1j To communicate an observation accurately, one must provide critical detail exactly what is being observed. Using that information, students will be able to definitively differentiate between or among similar objects and/or organisms.	
Researchers present the findings of investigations in the form of reports and formal presentation of those reports. A simple report reflects the method used in researching the problem and includes a title; introduction (rationale, purpose, and hypothesis); experimental design procedures, results (data tables and graphs) discussion of data (analysis); and conclusions.	• Identify the components that should be included in a formal written research presentation.
LS.1j Investigations do not always have to be experimental in nature (intended to test hypotheses). Rather, some investigations are observational (descriptive) studies.	• Distinguish between observational and experimental investigations.
LS.1j Whether observational or experimental in nature, conclusions from scientific studies are based both on verifiable observations and on inferences (science is empirical).	