MAPPING GRADE 4 SCIENCE INSTRUCTION

Concept: Science Process Skills
PWC Strand: Reasoning and Logic

CMS Unit Test: *Scientific Reasoning and Logic*
SOL Reporting Category: *Scientific Investigation*

PWC Objective: 4.1.1 / Infused

The student will begin to apply basic science process skills to a systematized method for planning and conducting investigations. Key concepts include:

- distinguishing between observations, conclusions, inferences, and predictions **(SOL 4.1a)**
- formulating hypotheses based on cause and effect relationships **(SOL 4.1b)**
- defining variables that must be held constant in an experimental situation **(SOL 4.1c)**
- selecting and using appropriate instruments to measure linear distance, volume, mass, and temperature **(SOL 4.1d)**
- selecting and using appropriate measurements to collect, record, and report data **(SOL 4.1e)**
- displaying data using bar and basic line graphs **(SOL 4.1f)**
- recognizing unusual or contradictory data in experimental results **(SOL 4.1g)**
- making predictions based on data from picture graphs, bar graphs, and basic line graphs **(SOL4.1h)**

What Students Should Know (Critical Attributes)	**What Students Should Be Able To Do** (Essential Skills)
Essential Questions: • What are the basic science skills used in problem solving? • What is the problem-solving process called that is used to answer scientific questions, and what is the basic progression of steps in the process? • What is a hypothesis and how is one formulated? • What must some variables be held constant in an experiment? **Critical Attributes:** 4.1a Distinctions are made among *observations, conclusions, inferences, and predictions.* An inference is a conclusion based on evidence about events that have already occurred. 4.1a There is a logical progression to using science skills to solve problems. This is known as a scientific process or scientific research method.	• Differentiate among simple observations, conclusions, inferences, and predictions. Correctly apply the terminology in oral and written work. This requires students to comprehend the basic terminology and apply it in situations related to Grade 4 science concepts.

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What Students Should Know (Critical Attributes)	**What Students Should Be Able To Do** (Essential Skills)
4.1b Hypotheses are formulated based on cause and effect relationships. Hypotheses are usually statements in the form of questions.	• Create a plausible hypothesis from a set of observations, stated in terms of cause and effect that can be tested. Hypotheses should be stated in terms such as, "if the water temperature is increased, then the amount of sugar that can be dissolved in it will increase".
4.1c Variables that must be held constant in an experimental situation are defined. When an experiment with a variable (things that change or vary) it is important in an experiment to change only one thing (the cause) or (independent or manipulated variable). Keep all other things (variables held constant) the same so that the results (the effect) or (dependent or responding variable) are based on the one thing we changed.	• Analyze the variable in a simple experiment, and decide which must be held constant (not allowed to change) in order for the investigation to represent a fair test. This requires students to comprehend what "variables" are, and apply the idea in new situations related to Grade 4 science concepts.
4.1d Appropriate instruments are selected to measure linear distance, volume, mass, and temperature.	• Use millimeters, centimeters, meters, kilometers, milliliters, liters, grams, and kilograms in measurement. • Choose the appropriate instruments including centimeter rulers, meter sticks, graduated cylinders, beakers, scales and balances, and Celsius thermometers for making basic metric measures.
4.1e Appropriate metric measures are used to collect, record, and report data in order to have enough data to be compared.	• Analyze a set of 20 or fewer objects, measures, or pictures; classify into basic categories to organize the data (descriptive or numerical); and construct bar graphs depicting the distribution of that data.
4.1f Data are displayed using bar and basic line graphs.	
4.1g Numerical data that is contradictory or unusual in experimental results are recognized.	• Judge which, if any, data in a simple set of results (generally ten or fewer numbers) appear to be considerably outside the expected range. Students should be able to determine the significance of unusual data.
4.1h Predictions are made based on data from picture graphs, bar graphs, and basic line graphs.	• Make predictions based on picture graphs, bar graphs and basic line graphs.