**Concept Block One: Scientific Inquiry**

1. **In this section we will concentrate on the following standard and its components:**

**Standard*:* 4Sa: The student will demonstrate an understanding of scientific inquiry, including the processes, skills, and mathematical thinking necessary to**

**conduct a simple scientific investigation.**

**4Sa.1:** Classify observations as either quantitative or qualitative.

**4Sa.2:** Use appropriate instruments and tools (including a compass, an anemometer,

 mirrors, and a prism) safely and accurately when conducting simple

 investigations.

**4Sa.3:** Summarize the characteristics of a simple scientific investigation that represent a fair test (including a question that identifies the problem, a prediction that

 indicates a possible outcome, a process that tests one manipulated variable at a

 time, and results that are communicated and explained).

**4Sa.4:** Distinguish among observations, predictions, and inferences.

**4Sa.5:** Recognize the correct placement of variables on a line graph.

**4Sa.6:** Construct and interpret diagrams, tables, and graphs made from recorded

 measurements and observations.

**4Sa.7:** Use appropriate safety procedures when conducting investigations.

1. **These concepts correspond to the following sections in the Scott**

 **Foresman Science textbook:**

1. xii- xvi, Using Scientific Methods for Science Inquiry
2. Any of the “Investigate Activity” sections spread throughout the text
3. **These concepts are encountered in the following *Reading Street* stories and articles:**

1) They Traveled with Lewis and Clark (Unit 1)

2) The Houdini Box (Unit 4)

3) So You Want To Be an Illusionist (Unit 4)

4) The Official Art of Hitting (Unit 6)

5) To Fly: The Story of the Wright Brothers (Unit 6)

6) Early Flying Machines (Unit 6)

1. **Concept Block 1 Content Summary:**

**4Sa.1:** Classify observations as either quantitative or qualitative.

 Content Summary:

* Whenever a scientist conducts an experiment, he starts by making observations. Those observations are recorded and become the first bits of information (data) in that particular study. In general, that collected information falls into one of two categories; quantitative or qualitative.
* Quantitative Data is any observation or information that deals with numbers, amounts, or measurements. When you hear “quantitative” think “quantity”.

If you are writing down numbers, your data is quantitative. Examples include things like:

* Temperature readings
* Measurements of length, height, width
* Changes in weight
* Number of subjects or participants
* Changes in population size
* Speeds
* Time intervals
* Qualitative Data is information gathered using your senses. When you hear ‘qualitative” think “qualities”. If you were asked to describe the qualities of a product or item you would probably do so in terms of color, smell, taste, texture, warmth, etc. These would be qualitative observations.
* Hot or cold
* Tall or flat
* Heavy or light
* Small or large
* Slow or fast
* Long or short

**4Sa.2:** Use appropriate instruments and tools (including a compass, an anemometer,

 mirrors, and a prism) safely and accurately when conducting simple

 investigations.

**4Sa.3:** Summarize the characteristics of a simple scientific investigation that represent a fair test (including a question that identifies the problem, a prediction that indicates a possible outcome, a process that tests one manipulated variable at a time, and results that are communicated and explained).

 Content Summary:

* All scientific investigations are based on what is commonly called “The Scientific Method”. The Scientific Method is the bedrock of all science, and it is therefore essential that students understand it. Luckily, the scientific method is not complicated or difficult. It is essentially a problem solving framework designed to ensure the validity of scientific research. However, this method is easily applied to any problem solving situation. The basic steps are as follows:
1. Observation- it starts with seeing a problem
2. Define the problem
3. Gather data/information
4. Hypothesis- make an informed guess about what’s going on
5. Experimentation- test your guess and look at your data
6. Conclusion: decide if your experiment supported your hypothesis

 (Was your hypothesis right or wrong?)

* Many factors can affect the results of an experiment. Those factors are called variables. (See 4Sa.5)

**4Sa.4:** Distinguish among observations, predictions, and inferences.

 Content Summary:

* An *observation* is a description based on information gathered using your senses (smell, taste, touch, sight, sound). An observation describes how something appears (see 4Sa1). It is a statement of *fact.*

 Example: The girl fell off her bike and is holding her knee.

* An *inference* is a judgment based on an observation. It is an *interpretation* of facts, or a *conclusion* drawn from evidence. Think of an inference as being present tense.

 Example: Her knee is injured.

* A *prediction* is a statement about what might happen next. It can be thought of as a type of inference. Think of a prediction as being future tense.

 Example: She will be sore tomorrow.

**4Sa.5:** Recognize the correct placement of variables on a line graph.

 Content Summary:

* Graphs can be useful for organizing and displaying quantitative data (see 4Sa1). Line and bar graphs are typically used to display scientific measurements and observations. Though students will be familiar with graphing in math, they may need a bit of assistance in transferring that knowledge to science and data collection. Essential to this is an understanding of variables in relation to graphing.
* Variables- are things like objects, events, time periods, or temperatures that you want to measure. Whatever causes a change in an experiment is a variable. There are two types of variables; dependent, and independent.
* Independent Variables- are factors that are *not changed* by other variables. You can think of an independent variable as if it’s an independent person. It is stubborn and won’t change. In an experiment they are what or who you are testing, they represent the constant factor. For example, say I want to graph changes in average temperature over a set number of days. The temperature will vary, the days will not, so the days are my independent variable. Independent variables should always be charted on the horizontal (X) axis.
* Dependent Variables- are factors that *do* change or vary throughout an experiment. Just as what you wear depends on the weather, dependent variables are always changing because of something else (the dependent variable). In the above example, the temperature (dependent variable) changes over time (independent variable). Dependent variables should be charted on the vertical (Y) axis. So the resulting graph would look like this:

Temperature Changes Over Time



 source: CIESE

**4Sa.6:** Construct and interpret diagrams, tables, and graphs made from recorded

 measurements and observations.

**4Sa.7:** Use appropriate safety procedures when conducting investigations.

1. **Suggested Labs and Activities:**

The following sites provide activities and ideas in support of the above standards. Some can be used as is; others may need to be leveled for use in the fourth Grade classroom. All of them can be used as references to provide ideas for assisting your instruction.

**4Sa.1:** Classify observations as either quantitative or qualitative.

<http://betterlesson.com/lesson/18169/qualitative-observations-vs-quantitative-observations>

<http://www.classroomscience.org/tell-a-story-quantitative-vs-qualitative>

<http://schools.dcsd.k12.nv.us/dhs/class/MOLSEN/Life%20Science/Life%20Science/Unit%201/Chapter%202/Qualitative%20vs%20Quantitative%20Data%20Lab.pdf>

**4Sa.2:** Use appropriate instruments and tools (including a compass, an anemometer,

 mirrors, and a prism) safely and accurately when conducting simple

 investigations.

<http://www.brighthubeducation.com/lesson-plans-grades-3-5/96243-teaching-students-how-to-use-a-compass/>

<http://kidsactivitiesblog.com/28674/make-a-compass>

<http://dnr.wi.gov/org/caer/ce/eek/cool/orienteering.htm>

**4Sa.3:** Summarize the characteristics of a simple scientific investigation that represent a fair test (including a question that identifies the problem, a prediction that

 indicates a possible outcome, a process that tests one manipulated variable at a

 time, and results that are communicated and explained).

<http://www.pbs.org/parents/catinthehat/explorer_guide_science_inquiry.html>

<http://beyondpenguins.ehe.osu.edu/issue/arctic-and-anarctic-birds/kids-becoming-scientists-through-schoolyard-inquiry>

<http://scienceforkidsblog.blogspot.co.uk/2013/06/gummy-bear-science.html>

**4Sa.4:** Distinguish among observations, predictions, and inferences.

<https://wikis.engrade.com/sciinf12>

<http://www.slideshare.net/mrmularella/observations-vs-inferences>

<http://www.myteacherpages.com/webpages/mri/review.cfm?subpage=803685>

**4Sa.5:** Recognize the correct placement of variables on a line graph.

<http://nces.ed.gov/nceskids/help/user_guide/graph/variables.asp>

<http://staff.tuhsd.k12.az.us/gfoster/standard/bgraph.htm>

**4Sa.6:** Construct and interpret diagrams, tables, and graphs made from recorded

<http://www.kidsmathgamesonline.com/numbers/mathdata.html>

<http://nces.ed.gov/nceskids/createAgraph/default.aspx>

**4Sa.7:** Use appropriate safety procedures when conducting investigations.

<http://www.sde.ct.gov/sde/lib/sde/pdf/curriculum/science/safety/scisaf_cal.pdf>