Name TEACHER KEY Period _____ Date _____

CHAPTER 2 NOTES

Environmental Science TOOLS OF ENVIRONMENTAL SCIENCE Chart

Directions: Fill in the information using the classroom or online Notes available at our website.

1.) Turned in completed chart on time and placed in notebook correctly after being checked. _____yes _____no
2.) All notes were correctly copied. _____yes _____no
3.) All notes were neat. _____yes _____no
4.) All information was written neatly with no spelling, punctuation, or writing errors. _____yes _____no

(Environmental Science Notebook Grade)

GEORGIA STANDARD:

SCSh3. Students will identify and investigate problems scientifically.

THE EXPERIMENTAL METHOD

Scientists make most of their discoveries using the *experimental method*.

This method consists of a series of steps that scientists worldwide use to identify and answer *questions*.

***OBSERVING* is the first step of the experimental method.**

- **Observation is the process of obtaining information by using the senses as well as the information obtained by using the senses.**
- **Observations can take many forms, including descriptions, drawings, photographs, and measurements.**

***HYPOTHESIZING* and predicting is the second step of the experimental method.**

- **A hypothesis is a theory or explanation that is based on observations and that can be tested.**
- **A hypothesis is not merely a guess.**
- **A good hypothesis should make logical sense and follow from what you already know about the situation.**
- **Predictions are statements made in advance that express the results that will be obtained from testing a hypothesis if the hypothesis is supported.**
- **A prediction is used to test a hypothesis.**

***EXPERIMENTATION* is the third step of the experimental method.**

- **Experiments are procedures that are carried out under controlled conditions to discover, demonstrate, or test a fact, theory, or general truth.**
- **An experiment is performed when questions that arise from observations cannot be answered with additional observations.**
- **Experiments should be designed to pinpoint cause-and-effect relationships.**

Experiments have two essential characteristics:

1. **A single variable is tested.**
2. **A control is used to compare the variable being tested.**

Experiments have two groups:

1. **The experimental group is the group in the experiment that is identical to the control group except for one factor and is compared with controls group.**
2. **The control group is the group in the experiment that serves as a standards of comparison with another group to which the control group is identical except for one factor.**

***ORGANIZING AND ANALYZING DATA* is the fourth step of the experimental method.**

- **Data is any pieces of information acquired through observation or experimentation.**
- **Organizing data into tables and graphic illustrations helps scientists analyze the**

data and explain the data clearly to others.
- **Graphs are often used by scientists to display relationships or trends in the data.**
- **Graphs of all kinds are used to present the information discovered in the experimental stage of the Experimental method. Examples include line graphs, pie graphs, bar graphs, and pictographs.**

DRAWING CONCLUSIONS is **the fifth step of the experimentation process when scientists analyze the data and compare the outcome of their experiments with their prediction or hypothesis.**

IMPORTANT FACTS ABOUT EXPERIMENTATION

- **Scientists often repeat their own experiments. *ALL EXPERIMENTS THAT PROVE THE HYPOTHESIS IS TRUE ARE REPEATABLE!***
- **The more often an experiment can be repeated with the same results, in different places and by different people, the more sure scientists become about the reliability of their conclusions.**
- **Scientists communicate their results by *publishing reports* in scientific articles to share what they have learned with other scientists.**
- **Scientific articles include the question the scientist explored, the reasons why the question is important, background information, a precise description of how the work was done, the data collected, and the scientist's interpretation of the data.**

FIVE SCIENTIFIC HABITS OF MIND

- **The first habit of mind is *curiosity*. Good scientists are endlessly curious which drives them to observe and experiment.**
- **The second habit of mind is *skepticism*. This means that good scientists don't believe everything that they are told.**
- **The third habit of mind is an *openness* to new ideas. Good scientists keep an open mind to how the world works.**
- **Another habit of mind is intellectual *honesty*. A good scientist is willing to recognize the results of an experiment even though it may mean that his or her hypothesis was wrong.**
- **Lastly, good scientists share *imagination* and creativity.**
- **They are not only open to new ideas, but able to conceive new ideas themselves.**

STATISTICS AND DECISION MAKING IN SCIENCE

GEORGIA SCIENCE STANDARD:
SEV4. Students will understand and describe availability, allocation and conservation of energy and other resources.
f.) Describe the need for informed decision making of resource utilization. (*i.e.* energy and water usage allocation, conservation, food and land, and long-term depletion)

WHAT ARE STATISTICS

Statistics **is the practice or science of collecting and analyzing numerical data in large quantities, especially for the purpose of inferring proportions in a whole from those in a representative sample.**

HOW SCIENTISTS USE STATISTICS

- **Scientists rely on and use statistics to *summarize, characterize, analyze, and compare data.***
- **Statistics is actually a branch of mathematics that provides scientists with important tools for analyzing and understanding their data.**

STATISTICS WORKS WITH POPULATIONS

- **Scientists use statistics to describe statistical *populations*.**
- **A statistical population is a group of similar things that a scientist is interested in learning about. (More women than men attend college.)**

WHAT IS AN AVERAGE

- **Statistical populations are composed of similar individuals, but these individuals often have different *characteristics*.**
- **A *mean* is the number obtained by adding up the data for a given characteristic and dividing this sum by the number of individuals.**
- **The mean provides a single numerical measure for a population and allows for easy comparison.**

DISTRIBUTION

- ***Distribution* is the relative arrangement of the members of a statistical population, and is usually shown in a graph.**
- **The graphs of many characteristics of populations, such as the heights of people, form bell-shaped curves.**
- **A *bell-shaped curve* indicates a normal distribution where the data is grouped symmetrically around the mean.**

WHAT IS PROBABILITY

- ***Probability* is the likelihood that a possible future event will occur in any given instance of the event.**
- **Probability is usually expressed as a number between 0 and 1 and written as a decimal rather than as a fraction.**
- **However, there must be a large enough sample size in order to obtain accurate results.**

RISK

- ***Risk* is the probability of an unwanted outcome.**
- **The most important risk we consider is the risk of death.**
- **Most people overestimate the risk of dying from sensational causes, such as plane crashes, but underestimate the risk from common causes, such as smoking.**
- **Likewise, most citizens overestimate the risk of sensational environmental problems and underestimate the risk of ordinary ones.**

MODELS

- ***Models* are patterns, plans, representations, or descriptions designed to show the structure or workings of an object, system or concept.**
- **Scientists use FOUR different types of models to help them learn about our**

environment.

1. ***physical models*** **- like the DNA model**
2. ***graphical*** **- like a map**
3. ***conceptual*** **- like verbal explanation or flow-chart diagram**
4. ***mathematical model*** **- like 2014 was the hottest recorded year globally since weather statistics have been written down**

VALUES AND THE ENVIRONMENT

- **Scientific *research* is an essential first step in solving environmental problems.**
- **However, before research can begin, an examination of values is usually needed.**
- **Values are principles or standards that an individual considers to be important.**
- **There are many values that affect environmental decision making.**

Values That Affect Environmental Decision Making

Value	Definition
Aesthetic	what is beautiful or pleasing
Economic	the gain or loss of money or jobs
Environmental	the protection of natural resources
Educational	the accumulation and sharing of knowledge
Ethical/moral	what is right or wrong
Health	the maintenance of human health
Recreational	human leisure activities
Scientific	understanding of the natural world
Social/cultural	the maintenance of human communities and their values and traditions

DECISION MAKING MODEL

1. ***Gather Information***
2. ***Consider Values***
3. ***Explore Consequences***
4. ***Make an Informed Decision***