Chapter 2
Tools of Environmental Science
Section 1, Scientific Methods
Day 1

The Experimental Method – Scientific Method

- Scientists make most of their discoveries using the _____.
- This method consists of a series of steps that scientists worldwide use _____.

Observing

- _____ is the process of obtaining information by using the senses as well as the information obtained by using the senses.
- Observing is the _____ step of the experimental method.
- Observations can take many forms, including _____.

Hypothesizing and Predicting

- A _____ is a theory or explanation that is based on observations and that can be tested.
- Forming a hypothesis is the _____ step of the experimental method.
- A hypothesis is not merely a guess.
- A good hypothesis should make _____about the situation.

Hypothesizing and Predicting

- _____ 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 _____.

Hypothesizing and Predicting

- It is important that any hypothesis can be disproved.
- Every time a hypothesis is disproved, the number of possible explanations for an observation is _____.
- By eliminating possible explanations, a scientist can zero in on the best explanation.

Experimenting

- _____ 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 _____ with additional observations.
- Experiments should be designed to pinpoint _____ relationships.

Experimenting

- Good experiments have two essential characteristics: _____.
- The _____ is the factor that changes in an experiment in order to test a hypothesis.
- To test for one variable, scientists usually study _____ or situations at one time, with the variable being the only difference between the two groups.

Experimenting

- The _____ is the group in the experiment that is identical to the control group except for one factor and is compared with controls group.
- The _____ is the group in the experiment that serves as a standard of comparison with another group to which the control group is identical except for one factor.

Organizing and Analyzing Data

- _____ is any pieces of information acquired through observation or experimentation.
- Organizing data into _____ helps scientists analyze the data and explain the data clearly to others.
- Graphs are used by scientists to display relationships or trends in the data.

Organizing and Analyzing Data

- Bar graphs are useful for comparing the data for several things in one graph.

Organizing and Analyzing Data

- Graphing the information makes the trends presented in tables easier to see.

Drawing Conclusions

- Scientists determine the results of their experiment by _____ of their experiments with their prediction.
- Ideally, this comparison provides the scientist with an obvious conclusion.

Drawing Conclusions

- However, often the conclusion is not obvious.
- In these cases, scientists often use _____ to help them determine whether the differences are meaningful or are just a coincidence.

Repeating Experiments

- Scientists often repeat their experiments.
- 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 look for a large amount of supporting evidence before they accept a hypothesis.

Communicating Results

- Scientists publish their results, sometimes in scientific articles, to share what they have learned with other scientists.
- Scientific articles include:
  - _____
  - _____
  - _____
  - _____
  - _____
  - _____

The Correlation Method

- When the use of experiments to answer questions is impossible or unethical, scientists test predictions by examining correlations.
- _____ is the linear dependence between two variables.

The Correlation Method

- An example is the relative width of a ring on a tree trunk is a good indicator of the amount of rainfall the tree received in a given year.
- Trees produce wide rings in rainy years and narrow rings in dry years.
- This method was used to help scientists investigate why the settlers at Roanake Island all died and why many died at the Jamestown Colony.

The Correlation Method

- Although correlation studies are useful, they do not necessarily prove cause-and-effect relationships between two variables.
- Scientists become more sure about their conclusions only if they find the same correlation in different places and as they continue to eliminate other possible explanations.

Scientific Habits of Mind

- Good scientists tend to share several key habits of mind, or ways of approaching and thinking about things.
- The first habit of mind is _____. Good scientists are endlessly curious which drives them to observe and experiment.
- The second habit of mind is _____. This means that good scientists do not believe everything that they are told.

Scientific Habits of Mind

- The third habit of mind is _____. Good scientists keep an open mind to how the world works.
- Another habit of mind is _____. A good scientist is willing to recognize the results of an experiment even though it may mean that his or her hypothesis was wrong.

Scientific Habits of Mind

- Lastly, good scientists share _____.
- They are not only open to new ideas, but also able to conceive new ideas themselves.
- They have the ability to see patterns where others do not or can imagine things that others cannot.
- This allows good scientists to expand the boundaries we know.