Background Section IV: Other

What is the "scientific method"?

The scientific method is a process for discovery. The process uses evidence that can be seen and tested, and is repeatable by anyone with the means to do so. Steps outlined here are the general process for the scientific method. However, in research, steps may be repeated or refined as new knowledge is gained.

- Observation aspect of the universe. Identify a question, about your observation, that can be tested through an experiment. Scientists attempt to provide quantitative (numerical) data whenever possible as the information can be analyzed.
- Form a Hypothesis - This is a statement or a prediction of what you think is the correct answer to your question. It is based on your observations and previous knowledge of the subject.
- Design Procedures to Test the Hypothesis. Controlled experiments use two trials simultaneously. One trial is the "control group" and the other the "variable". All factors are identical in the two trials, except ONE change or variable
- Experiment (repeat) Test the prediction through experimentation.
- Data Analysis and Interpretation
- Results/Conclusion
- When necessary, re-evaluate, modify the hypothesis and re-test the hypothesis.
- Formation of a theory which is a hypothesis that has been examined and found to withstand numerous tests. Theories provide a coherent set of propositions, which explain a class of phenomena. A theory is then a framework within which observations are explained and predictions are made for future experiments.
- Formation of a Scientific Law a statement that some aspect of nature is always observed to happen the same way and that no deviations have ever been seen.

What are the skills and abilities to do scientific inquiry?

According to the National Science Education Standards, the skills of scientific inquiry are detailed below. These are skills that scientists, including yourself, need to become familiar with and master.

Standard A1a-h (For more information see http://books.nap.edu/html/nses/html/6d.html.)

- Identify questions that can be answered through scientific investigations.
- Design and conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Develop descriptions, predictions, and models using evidence.
- Think critically and logically to make the relationships between evidence and explanations.
- Recognize and analyze alternative explanations and predictions.
- Communicate scientific procedures and explanations.
- Use mathematics in all aspects of scientific inquiry.

Standard A2f

Science advances through legitimate skepticism. Asking questions and querying other scientists' explanations is part of scientific inquiry. Scientists evaluate the explanations proposed by other scientists by examining evidence, comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same e observations.

Standard G1b

Science requires different abilities, depending on such factors as the field of study and type of inquiry. Science is very much a human endeavor, and the work of science relies on basic human qualities, such as reasoning, insight, energy, skill, and creativity--as well as on scientific habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.

Standard G2c

It is part of scientific inquiry to evaluate the results of scientific investigations, experiments, observations, theoretical models, and the explanations proposed by other scientists. Evaluation includes reviewing the experimental procedures, examining the evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations. Although scientists may disagree about explanations of phenomena, about interpretations of data, or about the value of rival theories, they do agree that questioning, response to criticism, and open communication are integral to the process of science. As scientific knowledge evolves, major disagreements are eventually resolved through such interactions between scientists.

Why keep a scientific journal?

There are a variety of reasons to keep a scientific journal. A few of those reasons are discussed here.

- The advancement of science and scientific knowledge depends on the ability to use the scientific method to prove, communicate and replicate experiments. A science journal is a place to keep accurate, detailed records of the things you think and do.
- Science is evolving. Over time and as a result of new technology, science advances. New ideas, questions and theories develop. A journal is a place where new advances can be combined with current knowledge to synthesize new information.
- Technical writing has its own characteristics that need to be understood and practiced. It is important to be able to communicate your own ideas in this format, as well as, be familiar with the process so that you can evaluate/critique the validity and reliability of someone else's work.
- A journal is a tool. It is a drawing board, a place to develop, outline/diagram and refine your questions and ideas. It is where you make observations, consider how those observations tie in to what is already known about a topic, reflect on scientific progress or experiments, advancements, set-backs, new ideas, further research questions, etc. It is a place where you can think about what you have just learned and where you can apply and incorporate it into your own unique, creative ideas.
- Like science, which is always changing, so are you. Everyday you grow as a learner and as your own teacher. A journal is an excellent place for self-reflection about your goals and your progress towards achieving those goals. It is a place for to look at what you've accomplished thus far and to decide what you want to learn/do next.
- A journal might also be called a portfolio or a collection of work. It provides an opportunity for you to demonstrate your knowledge, skills and abilities. It also can be an

excellent indicator of growth over time. If in a couple of years if you pull this journal out, you will realize how much you have grown and learned in the meantime.

- A journal can be an excellent assessment/grading tool. It can provide information to you, your parents and your teacher about your achievement and can be used to help plan future instruction.

Scientific conversions, equations, and measurements:

For more information about how scientists measure, please see
http://www.arcticice.org/metric.htm