SCIENTIFIC METHOD

Science Concept and Standard
- The concept for the scientific method is: Scientific progress is made by asking meaningful questions and conducting careful investigations.

- The standards are:
  f. Distinguish between hypothesis and theory as scientific terms.
  j. Recognize the issues of statistical variability and the need for controlled tests.
  n. Know that when an observation does not agree with an accepted scientific theory, the observation is sometimes a mistake or fraudulent and that the theory is sometimes wrong, new hypothesis and theories are developed.

1.0 Scientific Method
- scientific method >> an orderly way scientists solve problems.
- has 7 steps
  - define the problem
  - collect information/research
  - form a hypothesis
  - conduct an experiment
  - record observation and data
  - analyze the data
  - form a conclusion
  - publish the results

1.1 Define the Problem
- In order to solve a problem you must first have a clear understanding as to what the problem really is.
- Determine what is the main question that needs to be answered.
- a purpose or objective is what you want to learn about.
- a focus question is a problem addressed as a question

1.2 Collect Information
- once the problem is defined the next step is to collect information about the problem
- before starting a research or experiment collecting information can help develop the research or experiment or more important, you can find out if someone else has already solved the problem

1.3 Form a Hypothesis
- next step is to form a hypothesis.
- a hypothesis is an educated guess as to the likely outcome of an experiment or research.
- the hypothesis is based on the defined problem and the information collected.
- a hypothesis is written as one sentence, it should address the purpose/objective or the focus question

1.4 Conduct an Experiment
- once you have formed an hypothesis the next step is to test the hypothesis
- experiments are done to test hypothesis
1.5 Record Observations and Data
- while conducting the experiment all observations an data is recorded.
- data tables are placed in this section
- observations involve the 5 senses, what did you see, hear, taste, feel, or smell.

1.6 Analyze the Data
- perform calculations
- answer any analysis question
- graphs or models goes in this section

1.7 Form a Conclusion
- a conclusion is based on the analysis of experimental observations and data.
- a conclusion either accepts or rejects the hypothesis
- if a hypothesis is rejected and new one is written in the conclusion

1.71 Writing a Conclusion
- a conclusion is always written in paragraph form (short essay)
- in the conclusion stay away from terms such as: I, we, our, my, mine, I think, I believe, we think, etc
- a good conclusion should be positive and impersonal

- in your conclusion
  - state the purpose/objective or focus question
  - state the hypothesis
  - very briefly summarize the experiment and results.
  - quote your data only give pertinent information such as initial variables and final variables
  - compare the results to the hypothesis
    - if the results support the hypothesis, state so and explain how
    - if the results do not support the hypothesis, state so and explain why not, re-write a new hypothesis the agrees with the hypothesis

1.8 Publish your Results
- the results of experiments or research are published to the scientific community by journal articles, newspapers, and or books.
- in this class you will mainly publish your results in the form of a Lab Report

2.0 Components of an Experiment
- a controlled experiment has a control group
- control group > sets the standard for comparison
- an experiment involves variables
- variable > the part of an experiment that is altered (changed)
- there are 2 types of variables
  - independent variable > the part of the experiment that is manipulated (changed)
    - when making a graph the independent variable is plotted on the x-axis
  - dependent variable > the results of manipulation of the independent variable
    - when making a graph the dependent variable is plotted on the y-axis
3.0 Scientific Hypothesis, Theory, and Law
- **hypothesis** > is an educated guess as to the likely results of an experiment.
- the hypothesis should address the purpose or answer the focus question.

- **theory** > a statement (hypothesis) that is proven by repeatable experimental data.

- **scientific law** > a statement accepted as fact by the scientific community.

- a hypothesis develops into a theory and a theory may eventually become a law.