Study Guide: Scientific Method Unit

Please note: Be sure to review your scientific method note packet and other handouts when studying for the test. This study guide does not contain all of the information that will be on the test. My teacher site contains copies of power point presentations, handouts, labs and other materials from this unit.

DEFINITIONS:

scientific inquiry: A process that includes the various ways that scientists find out about the natural world and try to explain what they have observed.

scientific question: A ***question*** about the natural world that can be answered using observation, measurement, or controlled investigations. Does NOT contain opinions or personal values. May also be called a ***problem***.

observation: Information gathered using one or more of the senses. Can be ***qualitative*** (characteristics not involving numbers, such as color) or ***quantitative*** (measurements or numbers).

inference: An explanation of observations based on what you already know.

hypothesis: One possible answer to a scientific question.

- Written as a statement, not a question. Can be written as "I think that..." or "If…then…".
- It must be ***testable:*** researchers can carry out experiments and gather evidence that will either support or disprove the hypothesis.
- In the testable prediction, the manipulated variable comes after "If" and the responding variable comes after "then".

variable: A factor that can change in an experiment.

- **manipulated variable or independent variable**: A variable that is changed on purpose during an experiment. It is manipulated (changed) by the scientist.
- **responding variable or dependent variable**: The variable that changes in response to changes in the manipulated variable.
- **constants (or controlled variables)**: The variables that are kept the same in all groups and trials of an experiment.

controlled experiment: An experiment in which only **one** variable is changed at a time (the manipulated variable). This is the only way to know if one specific variable caused the results of the experiment.

- **experimental group**: In a controlled experiment, the group that is being studied. The researcher is changing the manipulated variable for this group.
- **control group**: In a controlled experiment, the scientist does NOT change the conditions of this group. The experimental group is compared to the control group when evaluating the results of the experiment.
    - **For example**: If a researcher studies the effects of a new medication on a group of patients, the experimental group gets the medication being tested and the control group receives a ***placebo*** (also called a sugar pill, it does not contain the medication being tested).

At the end of the experiment, the researcher compares the health of each group to determine how the medication affected the patients that received it.

A valid experiment: is a controlled experiment, has a large sample size, contains many trials, and is repeatable with the same results.

data: Facts, figures, and other evidence that scientists collect through observing. A data table is used to organize data collected during an experiment.

graphs: Can help scientists interpret data; can also reveal a trend or a pattern in data.

conclusion: A summary of what you have learned from an experiment. Restates the purpose of the experiment, summarizes data, states whether the data support or disprove the hypothesis, suggests improvements to the lab procedure, and identifies new research questions.

communicating: The ways in which scientists share ideas and experimental results with other scientists.

Steps in the scientific method:

1. State the problem (may also be called a question).
2. Form a hypothesis and prediction.
3. Design and perform an experiment.
4. Collect and analyze data (results).
5. Draw conclusions.
6. Communicate results.

The scientific method is a process with many paths, not a rigid sequence of steps. The steps may not be followed in order.

Graphing review:

1. Use the **data table** from your experiment.
2. Write the data table title at the top of the graph: The effect of (IV) on (DV).
3. Determine which variable in the data table is the manipulated (or independent) variable. Write the column heading from the data table on the x axis. Write the units in parentheses.
4. Determine which variable in the data table is the responding (or dependent) variable. Write the column heading from the data table on the y axis. Write the units in parentheses.
5. Create a scale for each axis: look at the range of numbers in the data table for each variable. Determine how to **EVENLY SPACE** numbers along the axis so your graph is large enough to analyze while fitting on the page. Your graph does not have to include (0,0) unless you have a data point at (0,0). When making your scale, think about how a ruler works. You can make accurate measurements with a ruler because the centimeter markings are evenly spaced and numbered in order without skipping numbers. Plan to use about 75% of the available space on the grid for your graph.
6. Use the data table to plot the points on the graph.
7. Connect points or draw a "best fit" line. DO NOT connect to (0,0) unless you have a data point at (0,0). DO NOT draw a line beyond the points in your data table.