Inquiry Review Guide

Scientific Instruments-

A ***spring scale*** is used to measure the weight or the force on an object.

- Some spring scales have a slider that moves in response to the weight/force of an object. The measurement is read on one of two scales located on either side of the slider.
- Before an object is attached to the spring scale, make sure the marker is on the zero (0) by adjusting the slider or knob usually found on the top of the scale.
- A spring scale measures weight or force in newtons (N).

A ***beam balance* (triple)** is a tool used to measure the mass of an object.

- The beam balance contains a pan or platform, three beams with riders/sliders and a pointer.
- Before measuring, make sure all riders/sliders are set at zero (0), the pointer is in line with its zero (0) mark and the pan is clean.
- Place an object to be measured on the pan or platform. If the object is placed in a container or on weighing paper, the mass of the container or paper needs to be subtracted from the final mass of the object.
- Three beams are found on the side opposite of the pan. Each beam is marked in different increments: 100 grams, 10 grams, and tenths (0.1) of a gram up to 10 grams.
- After placing the object on the pan, the pointer will rise.
- To determine the mass of the object, gently slide the riders/sliders across the beams until the pointer lines up exactly with the zero (0) mark on the scale. Be sure the riders/sliders with notches are securely placed in their notches.

- The mass is calculated by adding the sum of the measures indicated by the riders/sliders.
- A beam balance measures the mass of an object in grams (g).

A ***barometer*** is an instrument used to measure air pressure or a change in pressure readings.

- The other pointer that is found on most instruments is the *set pointer* and is usually made of brass.
- The set pointer can be turned by means of the knob at the center of the glass so that it covers the reading pointer. If the reading pointer has moved between readings then it can be determined that the pressure is now lower or higher and by how much.
- A barometer scale is measured in millimeters or inches of mercury or millibars (mb).

A ***sling psychrometer*** is a tool used to measure relative humidity by using two thermometers—a wet bulb and a dry bulb.

- The wet bulb thermometer is covered with a piece of cloth and moistened.
- The two thermometers are then moved through the air. After a period of time the temperature of each thermometer is recorded. A relative humidity chart is used to determine the relative humidity percent.

Scientific Investigation-

- Data should be collected throughout a controlled scientific investigation. Data includes both scientific observations and inferences.
- A ***scientific observation*** is gained by carefully identifying and describing properties using the five senses or scientific tools and can be classified as *quantitative* or *qualitative*.

- **Quantitative observations** are observations that use numbers (amounts) or measurements
- **Qualitative observations** are observations that are made using only the senses and refer to specific properties.
- An ***inference*** is an explanation or interpretation of an observation based on prior experiences or supported by observations made in the investigation. They are not final explanations of the observation. There may be several logical inferences for a given observation. There is no way to be sure which inference best explains the observation without further investigation.

Compiling Data-

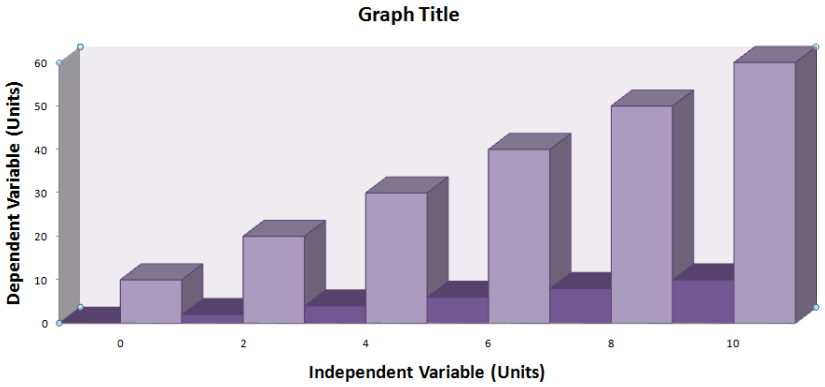
- Data from the investigation should be organized in data tables and represented as diagrams or graphs when appropriate.
- A ***data table*** is used to organize data collected in an experiment so that it can be read easily.
- A data table should be planned before the investigation starts.
- Consider the purpose of the table, the kind and number of items to be included in the table, the number of times a measurement will be made, and the units to be used.
- Data tables are often organized in columns and rows. The columns should have headings that show the quantity and unit of the data in that column.
- The independent (manipulated) variable is listed in the column on the left side. The dependent (responding) variable is listed in the column(s) on the right side.

Independent Variable	Dependent Variable

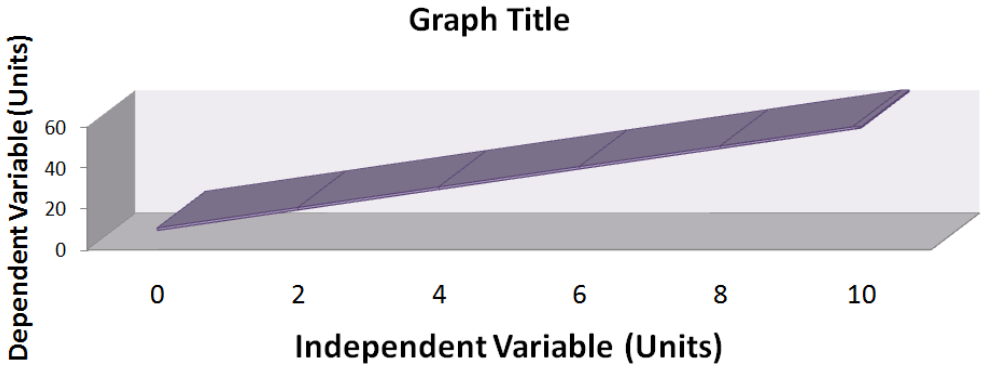
- If qualitative data is to be gathered, include enough space to write the observations.
- **Graphs** are visuals used to compare data. Graphs show information and

relationships between the data. Different types of graphs show different types of information.

- Pictographs use pictures of objects to show quantities.



- Bar graphs are often used for qualitative observations. The lengths of the bars on a bar graph are used to represent and compare data. A numerical scale is used to determine the lengths of the bars.
- Circle graphs show percentages of a whole. The entire circle is equal to 100% of the data.
- Line graphs are often used when quantitative data is collected over time. Line graphs show how quantitative data changes over time or relationships between manipulated (changing) variable and responding (resulting) variable. The lines on a line graph show the pattern of changes at a glance.
- How to draw a line graph: Draw a horizontal line (x-axis) and a vertical line (y-axis) that meet at a right angle.
- Identify the independent (manipulated) variable and the dependent (responding) variable from the data.



- The independent (manipulated) variable is written on the x-axis.

- The dependent (responding) variable is written on the y-axis.
- Include appropriate units of measurement for each variable.
- Look at the range of data (lowest and highest) to determine the *intervals* or *increments* (numbers on the axes) of the x-axis and the y-axis.
- The increments do not need to be the same for both the x-axis and the y-axis, but should be consistent on either axis.
- Label the point at the right angle as zero (0).
- Plot the data on the graph as matched pairs. For example, every independent (manipulated) variable number will have a corresponding dependent (responding) variable number. Connect the points on the line graph.
- Write an appropriate title for the graph that contains the names of both variables.
- "DRY MIX" can help you remember which variable belongs on the axis.
- DRY represents Dependent-Responding-Y-axis. MIX represents Manipulated-Independent-X-axis.
- Sometimes calculations or graphs will be needed to help analyze the data. Data will often reveal patterns or trends.
- The analyzed data can then be used to draw a valid conclusion about the investigation.
- A ***valid conclusion*** is a summary of the findings of an experiment based on scientific observations, inferences, and collected data that states the relationship between the independent (manipulated) and dependent (responding) variables.
- When a conclusion statement is made it should state whether the collected data supports the hypothesis or does not support the hypothesis (not that the hypothesis was right or wrong).

Classifying Objects and Organisms-

- Objects can be classified based on similar characteristics using a binary classification chart (based on whether or not an object has or does not have a particular property) or an identification key.
- A ***dichotomous key*** is a special identification key that uses a series of paired characteristics that leads to the identification of an organism, object, or material.
- Always begin with a choice from the first pair of characteristics.
- At the end of each characteristic is either the name of the organism, object, or material or directions to go to another step.
- Keep following the choices until the identity is determined.
- Once the identity is determined, the physical characteristics can be identified.

Technological Design-

- **Science** is the process of learning about the natural world by asking questions and trying to find the answers to those questions. Scientific knowledge is used to develop and enhance science knowledge. **Technology** applies scientific knowledge in order to develop a solution to a problem or create a product to help meet human needs. Technology is usually developed because there is a need or a problem that needs to be solved. Steps in the technological design process include:
- **Identifying a problem or need**
- Research and gather information on what is already known about the problem or need
- **Designing a solution or a product**
- Generate ideas on possible solutions or products
- Evaluate the factors that will limit or restrict the solution or product design
- Determine the trade-offs of the solutions or products (what must be given up in order to create the solution or product)
- **Implementing the design**

- Build and test the solution or product
- Identify any problems with the solution or product
- If necessary, redesign the solution or product to eliminate any problems in the design
- **Evaluating the solution or the product**
- Determine if the solution or product solved the problem
- Identify the pros and cons of the solution or product
- The steps of the design can be communicated using descriptions, models, and drawings.
- A *scientific model* is an idea that allows us to create explanations of how the something may work. Models can be physical or mental.

Controlled Experiments-

- In a *controlled scientific investigation* some or all of the following steps should be included:
- Identify a testable question (tests one variable) that can be investigated
- Research information about the topic
- State the hypothesis as a predicted answer to the question, what may be the possible outcome of the investigation
- Design an experiment to test the hypothesis, controlling all variables except the independent (manipulated) variable
- Plan for independent (manipulated) and dependent (responding) variables
- Plan for factors that should be held constant (controlled variables)
- List the materials needed to conduct the experiment
- List the procedures to be followed
- Plan for recording, organizing and analyzing data
- Conduct the experiment and record data (observations) in tables, graphs, or charts
- Analyze the data in the tables, graphs, or charts to figure out what the data

means (describe the relationship between the variables)

- Compare the results to the hypothesis and write a conclusion that will support or not support the hypothesis based on the recorded data
- Communicate the results to others

Lab Safety-

- Care should be taken when conducting a controlled scientific investigation to make sure that everyone stays safe.
- **Safety procedures** to use when conducting science investigations must be:
- Always wear appropriate safety equipment such as goggles or an apron when conducting an investigation.
- Be careful with sharp objects and glass. Only the teacher should clean up broken glass. Do not put anything in mouth unless instructed by the teacher.
- Follow all directions for completing the science investigation. Follow proper handling of animals and plants in the classroom. Keep hands away from eyes when using iron filings.
- Keep the workplace neat. Clean up when done.
- Practice all of the safety procedures associated with the activities or investigations conducted. Tell the teacher about accidents or spills right away.
- Use caution when working with heat sources and heated objects. Wash hands after each activity.