Name _____ Date _____ Class _____

Scientific Inquiry

Directions for Homework

- Read each article/ summary and annotate the article using the annotation strategies. I am looking for underlining/ highlighting, margin notes, and questions.
- Answer each question in complete sentences.

Your thinking and questioning can be the start of the **scientific inquiry** process. **Scientific inquiry refers to the diverse ways in which scientists study the natural world and propose explanations based on the evidence they gather.**

The scientific inquiry process involves posing questions and developing a hypothesis. A **hypothesis** is a possible explanation for a set of observations or answer to a scientific question. **In science, a hypothesis must be testable. This means that researchers must be able to carry out investigations and gather evidence that will either support or disprove the hypothesis.**

To test a hypothesis, you must design an experiment. All **variables**, or factors that can change in an experiment, must be exactly the same. An experiment in which only one variable is manipulated at time is called a **controlled experiment**. The one variable that is purposely changed to test a hypothesis is called the **manipulated variable** (also called the independent variable). The factor that may change in response to the manipulated variable is called the **responding variable** (also called the dependent variable).

Another important aspect of a well-designed experiment is having clear operational definitions. An **operational definition** is a statement that describes how to measure a particular variable or define a particular term.

Data are facts, figures, and other evidence gathered through observations. A data table provides you with an organized way to collect and record your observations during an experiment. After being collected, data are interpreted, a conclusion is drawn, and the results need to be shared. **Communicating** is the sharing of ideas and experimental findings with others through writing and speaking.

A **scientific theory** is a well-tested explanation for a wide range of observations or experimental results. A **scientific law** is a statement that describes what scientists expect to happen every time under a particular set of conditions. **Unlike a theory, a scientific law describes an observed pattern in nature without attempting to explain it.**

One reason to study scientific theories and laws is to have scientific literacy. Having **scientific literacy** means that you understand basic scientific terms and principles well enough that you can evaluate information, make personal decisions, and take part in public affairs. **By having scientific literacy, you will be able to identify good sources of scientific information, evaluate them for accuracy, and apply the knowledge to questions or problems in your life.**

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Scientific Inquiry

Understanding Main Ideas

Answer the following questions in the spaces provided.

1. What role does posing a question play in a scientific inquiry?

2. What makes a hypothesis testable?

3. How is a scientific law different from a scientific theory?

Building Vocabulary

Write the definition for each of the following terms on the lines below.

4. data

5. controlled experiment

6. communicating

7. operational definition

Name _____ Date _____ Class _____

Measurement—A Common Language

Key Concepts

- Why do scientists use a standard measurement system?
- What are the SI units of measure for length, mass, volume, density, time, and temperature?
- How are conversion factors useful?

The **metric system** is a system of measurement based on the number 10. Modern scientists use a version of the metric system called the International System of Units, abbreviated as **SI**. **Using SI as the standard system of measurement allows scientists to compare data and communicate with each other about their results.** SI units are based on multiples of 10.

The distance from one point to another is length. **The basic unit of length in the SI system is the meter (m).**

A measure of the amount of matter an object contains is the **mass** of the object. **The basic unit of mass in the SI system is the kilogram (kg).** Mass is not the same thing as weight, although the two are often confused. **Weight** is a measure of the force of gravity acting on an object.

The amount of space an object takes up is its **volume**. To measure volume of a liquid, scientists use units known as the liter (L) or milliliter (mL). They also use a tool called a graduated cylinder, in which the top surface of the liquid is curved. This curve is called the **meniscus.**

Density is a measure of how much mass is contained in a given volume. To calculate the density of an object, divide its mass by its volume. **Because density is actually made up of two other measurements—mass and volume—an object's density is expressed as a combination of two units.** Two common units of density are grams per cubic centimeter (g/cm^3) and grams per milliliter (g/mL).

The second (s) is the SI unit used to measure time. To measure temperature, scientists commonly use the Celsius temperature scale. **In addition to the Celsius scale, scientists sometimes use another temperature scale, called the Kelvin scale. In fact, the kelvin (K) is the official SI unit for temperature.**

To convert one measurement to another, you need to know the appropriate conversion factor. A conversion factor is an equation that shows how two units of measurement are related.

Name _____ Date _____ Class _____

Measurement—A Common Language

Understanding Main Ideas

Complete the table below.

Measurement	Basic or Official SI Unit	Common Tool Used
length		
	kilogram, gram	
		graduated cylinder
time		
		thermometer

Buliding Vocablulary

Match each term with its definition by writing the letter of the correct definition on the line beside the term in the left column.

____ 1. metric system
____ 2. SI
____ 3. mass
____ 4. weight
____ 5. volume
____ 6. density

a. a measure of the force of gravity acting on an object
b. version of the metric system used by modern scientists called the International System of Units
c. the amount of space an object takes up
d. a measure of h ow much mass is contained in a given volume
e. a measure of the amount of matter an object contains
f. a system of measurement based on the number 10

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Graphs in Science

Key Concepts

- What type of data can line graphs display?
- How do you determine a line of best fit or the slope of a graph?
- Why are line graphs powerful tools in science?

You can think of a **graph** as a "picture" of your data. **Line graphs are used to display data to show how one variable (the responding variable)** changes in response to another variable (the manipulated variable). **A line** graph has several parts.

- **A horizontal axis (or x-axis) and a vertical axis (or y-axis)**—The **horizontal axis**, or x-axis, is the graph line that runs left to right. The **vertical axis**, or y-axis, is the graph line that runs up and down. The point where they cross is the **origin**.
- **Labels on the axes**—The horizontal axis shows the manipulated variable and the vertical axis shows the responding variable.
- **A point on the graph for each piece of data**—A **coordinate** is the pair of numbers used to determine the position of a **data point** on the graph.
- **A line connecting the data points**—The line shows the trend of the data.
- **A title**—The title explains what the graph shows.

A straight line is drawn between the data points to reflect the general pattern. This graph line, called the **line of best fit**, may touch very few or none of the points. **A line of best fit emphasizes the overall trend shown by all the data taken as a whole.** A line graph in which the data points yield a straight line is called a **linear graph. The slope of a graph line tells you how much y changes for every change in x.**

A line graph in which the data points do not fall along a straight line is called a **nonlinear graph. Line graphs are powerful tools in science because they allow you to identify trends and make predictions.**

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Graphs in Science

Understanding Main Ideas

Answer the following questions in the spaces provided.

1. How are line graphs used to show the relationship between variables?

2. What axes are on a line graph and what variables do these axes show?

3. What does a line of best fit emphasize?

4. Why are line graphs powerful tools in science?

Building Vocabulary

Write the definitions for each of the following items on the lines below.

5. horizontal axis

6. origin

7. data point

8. linear graph

9. nonlinear graph