Name _____ Class _____ Date _____



# Summary

## 1.1 What Is Science?

Science is a system of knowledge and the methods you use to find that knowledge. Science begins with curiosity and often ends with discovery. Curiosity provides questions but is usually not enough to arrive at scientific results. Methods such as observing and measuring provide ways to find answers. In some experiments, observations are qualitative, which means they are descriptive. In others, they are quantitative, which means they are numerical.

Technology is the use of knowledge to solve practical problems. The goal of science is to expand knowledge. The goal of technology is to apply that knowledge. Science and technology depend on each other. Advances in one lead to advances in the other.

The study of science is divided into social science and natural science. Natural science is generally divided into three branches:

- physical science,
- Earth and space science,
- life science.

The two main areas of physical science are chemistry and physics. Chemistry is the study of the makeup, structure, properties, and reactions of matter. Physics is the study of matter and energy and the interactions between the two through forces and motion.

The foundation of Earth science is geology, the study of the origin, history, and structure of Earth. The foundation of space science is astronomy, the study of the universe beyond Earth, including the sun, moon, planets, and stars.

The study of living things is known as biology, or life science.

The basic rules of nature can be thought of as the big ideas of physical science. These big ideas include

- space and time,
- matter and change,
- forces of motion,
- energy.

## 1.2 Using a Scientific Approach

An organized plan for gathering, organizing, and communicating information is called a scientific method. The goal of any scientific method is to solve a problem or to better understand an observed event.

Scientific investigations often begin with observations. An observation is information that you obtain through your senses. A next step often involves forming a hypothesis. A hypothesis is a proposed answer to a question.

For a hypothesis to be useful, it must be testable. Scientists perform experiments to test their hypotheses. In an experiment, any factor that can change is called a variable. A variable that causes change in another variable is called a manipulated variable. The responding variable is the variable that changes in response to the manipulated variable. A controlled experiment is an experiment in which only one variable, the manipulated variable, is deliberately changed at a time.

Based on the data produced by an experiment, scientists can draw a conclusion about whether the evidence supports or disproves the hypothesis. Once a hypothesis has been supported in repeated experiments, scientists can begin to develop a theory. A scientific theory is a well-tested explanation for a set of observations or experimental results.

After repeated observations or experiments, scientists may arrive at a scientific law, which is a statement that summarizes a pattern found in nature. A scientific law describes an observed pattern in nature without attempting to explain it. The explanation of such a pattern is provided by a scientific theory.

A model is a representation of an object or event. Scientific models make it easier to understand things that might be too difficult to observe directly.

Whenever you work in your science laboratory, it's important to follow safety precautions at all times. The single most important rule for your safety is simple: Always follow your teacher's instructions and the textbook directions exactly.

## 1.3 Measurement

Scientists often work with very large or very small numbers. Instead of writing out all the zeroes in such numbers, you can use a shortcut called scientific notation. Scientific notation is a way of expressing a value as a product of a number between 1 and 10 and a power of 10. For example, the number 300,000,000 written in scientific notation is $3.0 \times 10^8$. Using scientific notation makes very large or very small numbers easier to work with.

Scientists use a set of measuring units called SI, or the International System of Units. SI is built on seven metric units, known as base units.

- the meter (m) for length
- the kilogram (kg) for mass
- the kelvin (K) for temperature
- the second (s) for time
- the mole (mol) for amount of substance
- the ampere (A) for electric current
- the candela (cd) for luminous intensity

Additional SI units, including volume and density, are called derived units. Derived units are made from combinations of base units.

The base unit for a given quantity is not always a convenient one to use. The measurement can be written in a more compact way using a metric prefix. A metric prefix indicates how many times a unit should be multiplied or divided by 10.

Precision is an assessment of how exact a measurement is. Significant figures are all the digits that are known in a measurement, plus the last digit that is estimated. The fewer the significant figures, the less precise the measurement is. The precision of a calculated answer is limited by the least precise measurement used in the calculation. Another important quality of measurement is accuracy, which is the closeness of a measurement to the actual value of what is being measured.

## 1.4 Presenting Scientific Data

A relationship in which the ratio of two variables is constant is a called a direct proportion. A relationship in which the product of two variables is a constant is called an inverse relationship.

A bar graph is often used to compare a set of measurements, amounts, or changes. A circle graph is a divided circle that shows how a part or share of something relates to the whole.

A crucial part of any scientific investigation is reporting the results. Scientists can communicate results by writing in scientific journals or speaking at conferences. Different scientists may interpret the same data differently. This is the basis for peer review, a process in which scientists examine other scientists' work.