

Physical Science Notes:

Unit 1: The Process of Science

Lesson 1: Using The Scientific Methods

Skills Scientists use in their Investigations:

- Modern scientific inquiry evolved from earlier forms of investigation developed in many cultures.
- Scientific inquiry is a logical process used to investigate a phenomenon.
- The scientific method is a series of steps that can be applied to scientific inquiry.
- Steps in the scientific method include:
 - Asking a question
 - Conducting background research
 - Developing a **hypothesis**
 - Designing and conducting an **experiment**
 - Collecting and analyzing **data**
 - Developing conclusions
 - Communicating findings

There are many ways to conduct scientific inquiry without using all of these steps.

Scientific Investigations:

Scientific investigation commonly uses one of the following approaches:

- Experimental investigations focus on the cause and effect relationship between independent and dependent variables.
- Comparative investigations focus on the similarities and differences between different organisms, samples, or systems. .
- Descriptive investigations focus on observations made without experimentation. They usually do not contain a hypothesis.

Field investigations are investigations that take place outside of the traditional laboratory, where it is often too difficult to replicate the environment.

Variables and Controls in an Investigation:

An experiment is a test designed to determine whether a hypothesis is supported or refuted.

- A **control** is treated as the experimental condition and is not manipulated.
- The independent **variable** is manipulated.
- The dependent **variable** is what the experimenter is measuring.
- Constants are variables in an experiment that are not being tested or measured and should, therefore, remain constant throughout the experiment.

Recording Observations:

- Depending on the nature of the experiment, data can be recorded manually or captured using such technology as digital photography, videography, and remote sensors.

Measuring and Graphing Data:

- SI units are preferred units of measurement.
- Data can be organized in tables and displayed as charts or graphs.

Analyzing Results:

- The simplest form of data **analysis** is to check for a linear relationship between the independent variable and the dependent variable.

Interpreting Data to Formulate Conclusions:

- The **conclusion** is a deduction or inference of whether the results support or refute the hypothesis.
- When the results are ambiguous or unexpected, a discussion of possible reasons or potential errors is provided.
- Solutions are often proposed to resolve issues with the experimental results.

Hypotheses, Theories, and Laws:

A hypothesis is an educated guess about the answer to a question.

- A hypothesis is a statement that describes a relationship between variables in an experiment.
- A hypothesis should be testable.
- A **theory** is an explanation for why things occur that is based upon repeated observation and experimental results.
- A **law** is a statement, based upon repeated observations and experimental results, that describes a natural or physical phenomenon that always happens under the same conditions.