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Learning About the World

Objective

In this lesson, we will review what science encompasses, how it works, and cover some of the diversity of its fields, spanning all human knowledge.

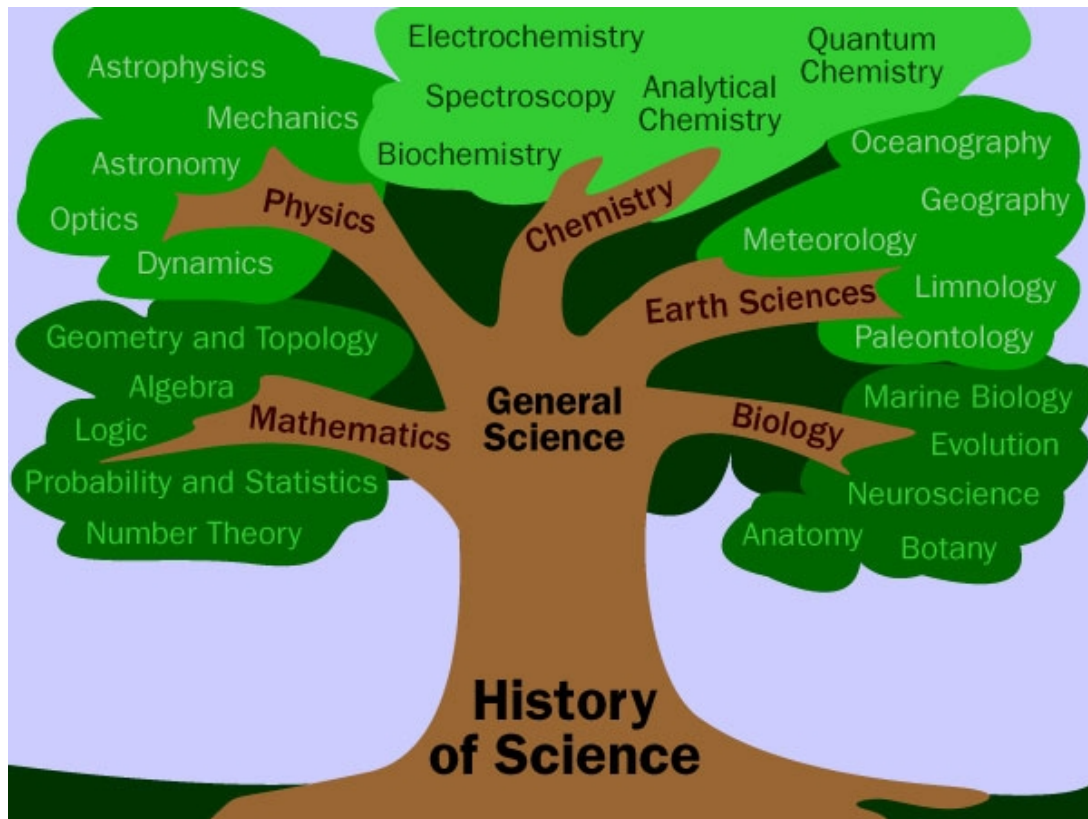
What is Science?

The word science comes from a Latin word that means, “to know.” However, science is more than just a collection of facts and knowledge. It is the **method** of observing nature and the universe, and of testing explanations for how and why things are the way they are. Scientists search for the truth. They try to uncover facts and get a better understanding of the natural world and how its parts are interrelated. Scientific knowledge and understanding are built on the principle that the universe can be explained in terms of cause and effect. Although there are many definitions of science, only two are useful in our modern understanding: empiricism and realism. According to empirical philosophy, scientific theories are objective, testable, and predictive of results that can be checked and possibly falsified through proper experimentation. On the other hand, scientific realism is more akin to identifying objects and processes; their causes, constituents, or origins; and the manner in which the causes or origins work. In short, empiricism is more about asking questions about reality; realism is more about identifying structure and cause. It may seem to be a subtle difference and the two are tightly linked in an everyday-real-world definition of science.

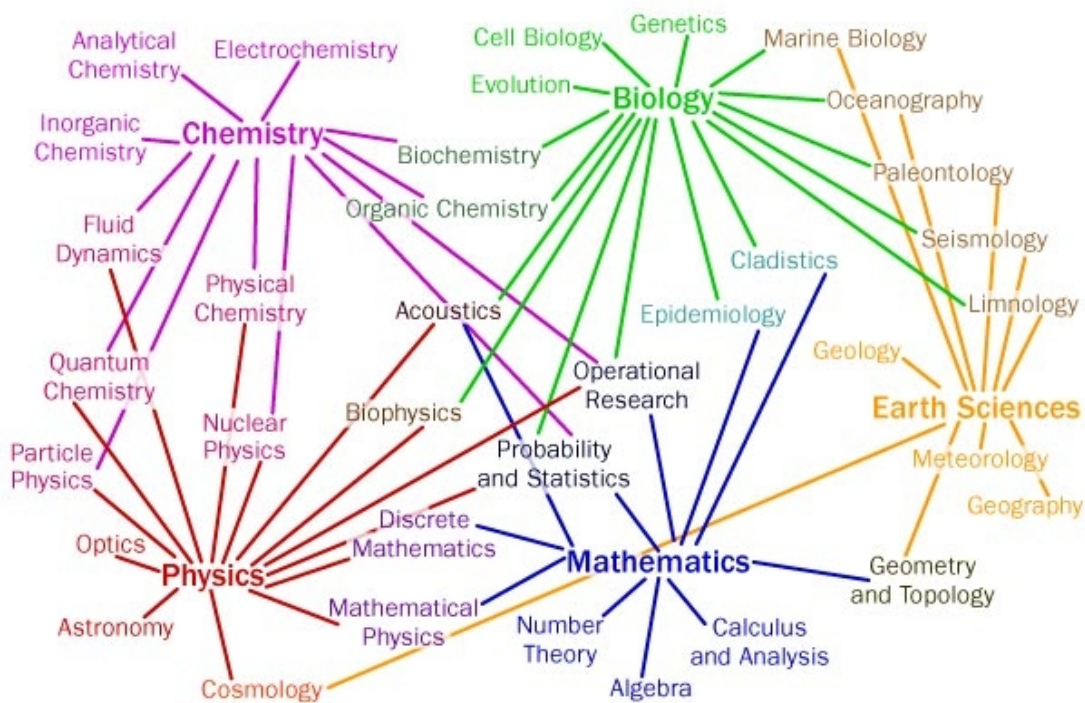
An important philosopher of science, Karl Popper, argued that verification is impossible in science and that scientific hypotheses can only be falsified. Thomas Kuhn also stated that human bias taints all observations with preconceptions that are based on the current paradigm. Kuhn argued that science involves paradigms and assumptions, and that scientific progress is mainly gained through the falsification or modification of paradigms. He also stated that the emergence of newer and more powerful paradigms occurred in a cycle that never ends. Kuhn pointed out that science has never historically proceeded as a steady accumulation of facts, but as a series of dramatic (and sometimes cataclysmic) paradigm shifts that precipitate scientific revolution.

There are no arbitrary decisions that control our lives. Storms occur not because of angry supernatural beings, but rather because a certain amount of energy from the sun has heated parts of Earth more than others. Energy flows between these places

in a predictable way that follows natural laws. This flow of energy causes the storms and other atmospheric phenomena. We employ science as a powerful tool; observations are used to make predictions about how the universe works. Almost every part of our daily lives is based on scientific knowledge and its applications.



Because science covers a lot of conceptual ground people separate it into different branches of knowledge. The term branches might indicate that the fields of science can be shown in a tree-like diagram. However, as our storehouses of knowledge expand, a web of knowledge may display science more accurately. No matter how you prefer to visualize the complexity of science, you should realize that all of scientific progress is interrelated and there are no isolated disciplines within science — everything is connected.



Broad fields of scientific study include:

- **Biology:** the study of life. This is one of the broadest disciplines of science and is significant as we learn more about ourselves and our place in the natural world.
- **Geology:** the study of Earth. Geological sciences are at the juxtaposition of astronomy and Earth Sciences.
- **Chemistry:** the study of elements and the interactions of their atoms.
- **Physics:** the study of the physical universe and how its parts interact.
- **Mathematics:** the study of numbers and shapes. Although mathematics is a field of science on its own, it is also the glue that holds the others together.

Most scientific investigations do not fall strictly within one of these classifications. There is tremendous overlap and interconnection among them. Within and between these broad fields, there are many other classifications of science. These include fields such as biochemistry and geophysics, that combine concepts from two or more of the broad fields. Others, for example, botany and organic chemistry, are specialties within one of the broad fields. In addition, the principles of science are used by sociologists, economists, psychologists, and others who study human behavior. The main idea to remember is that science is a process that encompasses the whole range of causes and effects in the natural world and our systematic attempts to understand it all.

Question

Science is