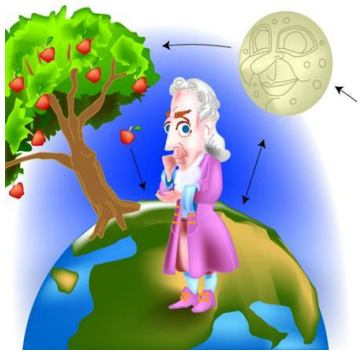
Physical Science 10

Chapter 1: World of Science?

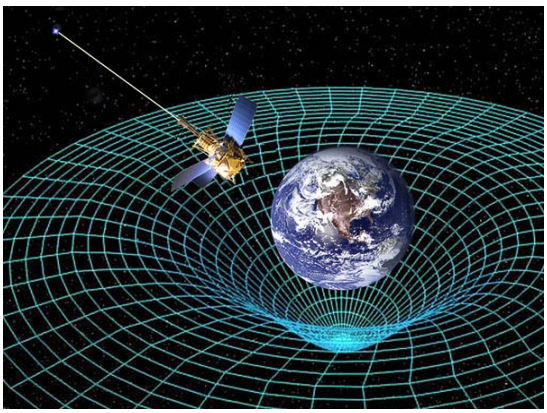


Lesson Objectives

- Define science.
- Explain how scientists use induction.
- Distinguish between scientific theories and laws.
- Describe milestones in the history of science.
- Identify contributions of women and minorities to science.

Lesson Vocabulary

- induction
- science
- scientific law
- scientific theory



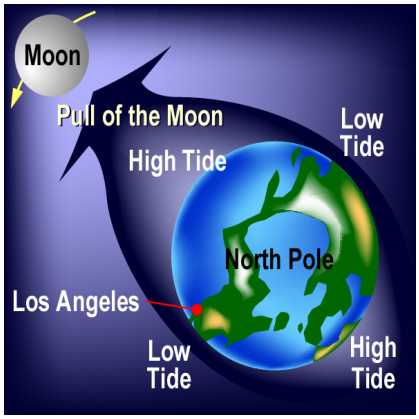
Introduction

Understanding the "hows" and "whys" of the world is the goal of science. The term science comes from a Latin wo that means "having knowledge." ***But science is as muc about adding to knowledge as it is about having knowledge***. Science is a way of thinking as well as a se facts. ***Science can be defined as a way of learning ab the natural world that is based on evidence and logi.***

Induction

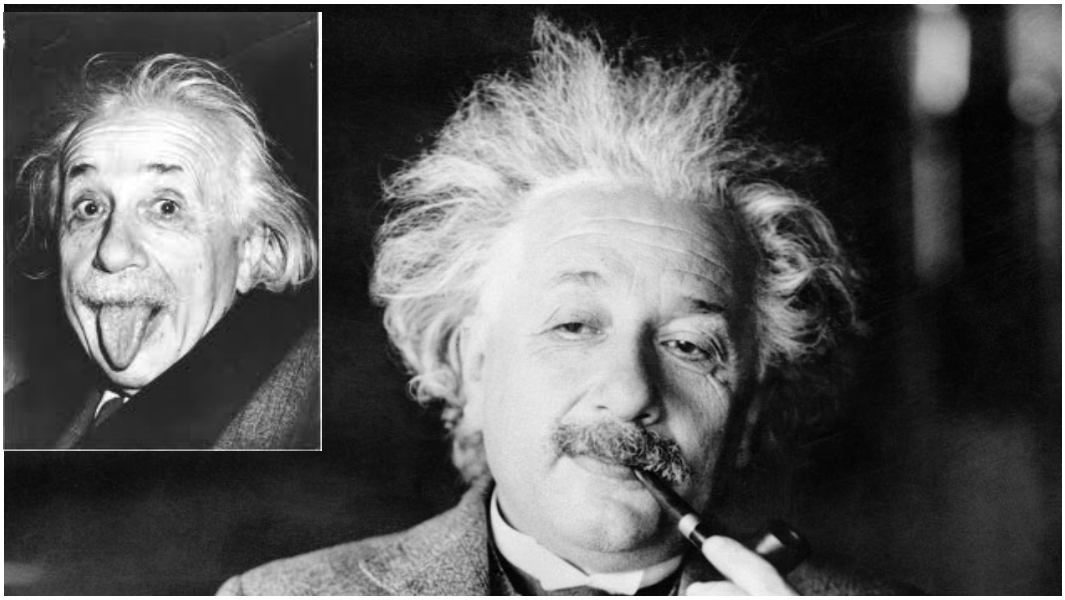
data collection

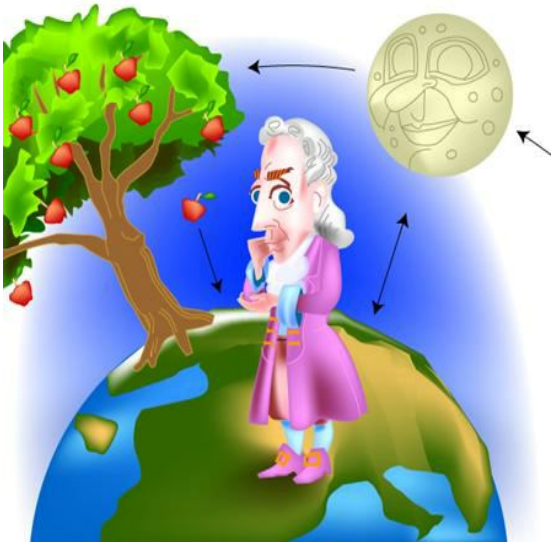
Drawing general conclusions from many individual **observations** is called **induction**.

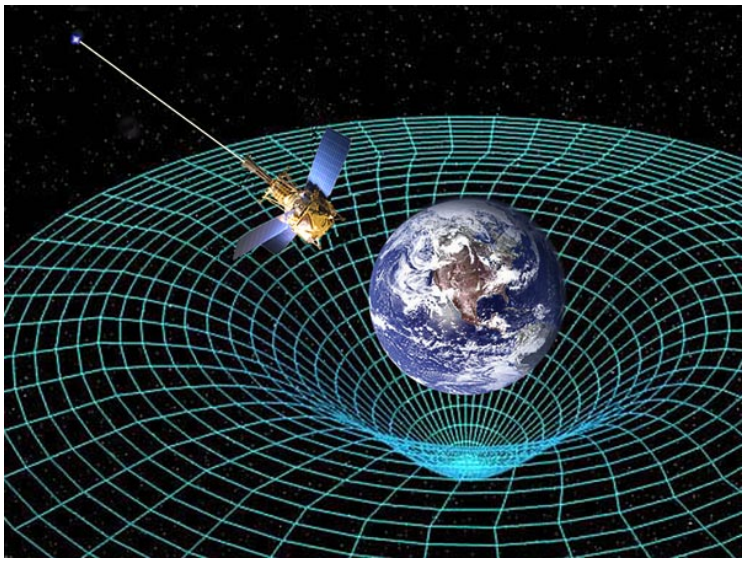


How Science Advances

The above example shows how science generally advances. New evidence is usually used to improve earlier ideas rather than entirely replace them. In this way, scientists gradually refine their ideas and increase our understanding of the world. On the other hand, sometimes science advances in big leaps. This has happened when a scientist came up with a completely new way of looking at things. For example, Albert Einstein came up with a new view of gravity. He said it was really just a dent in the fabric of space and time.







Hammer vs Feather - Physics on the Moon- Galileo and Apollo 15 - YouTube

Different conclusions can be drawn from the same observations, and it's not possible to tell which one is correct. For example, based on observations of the sun moving across the sky, people in the past couldn't tell whether the sun orbits Earth or Earth orbits the sun. Both models of the solar system are pictured in Figure 1.3. It wasn't until strong telescopes were invented that people could make observations that let them choose the correct idea.

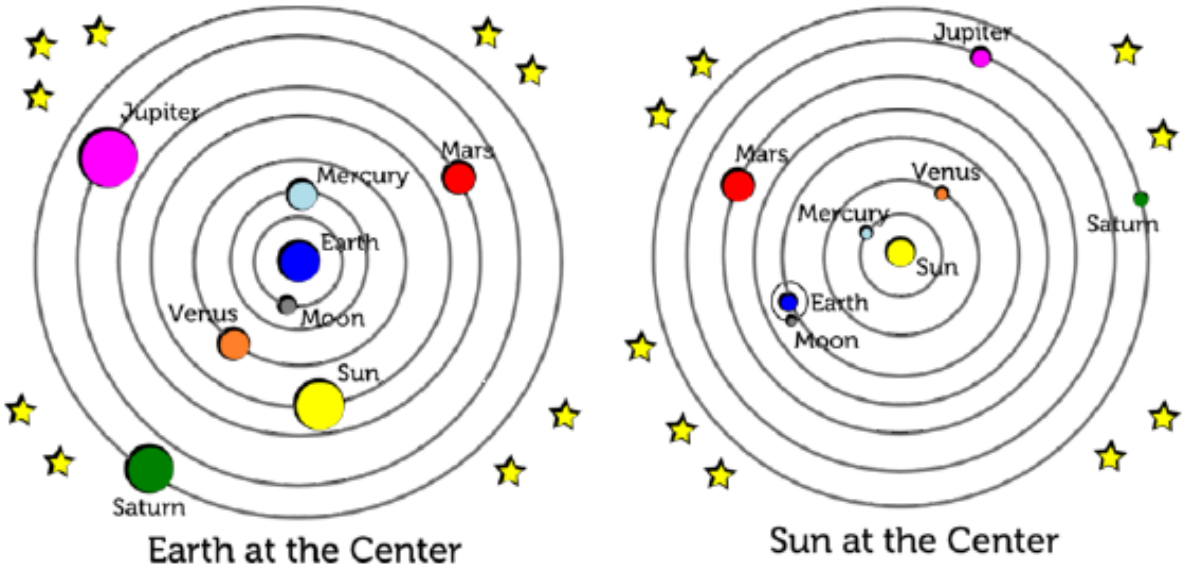


FIGURE 1.3

Both of these models could explain why the sun appears to move across the sky each day. Other observations were needed to decide which model is correct.

Mars Epicycles

Path of Mars

Heliocentric

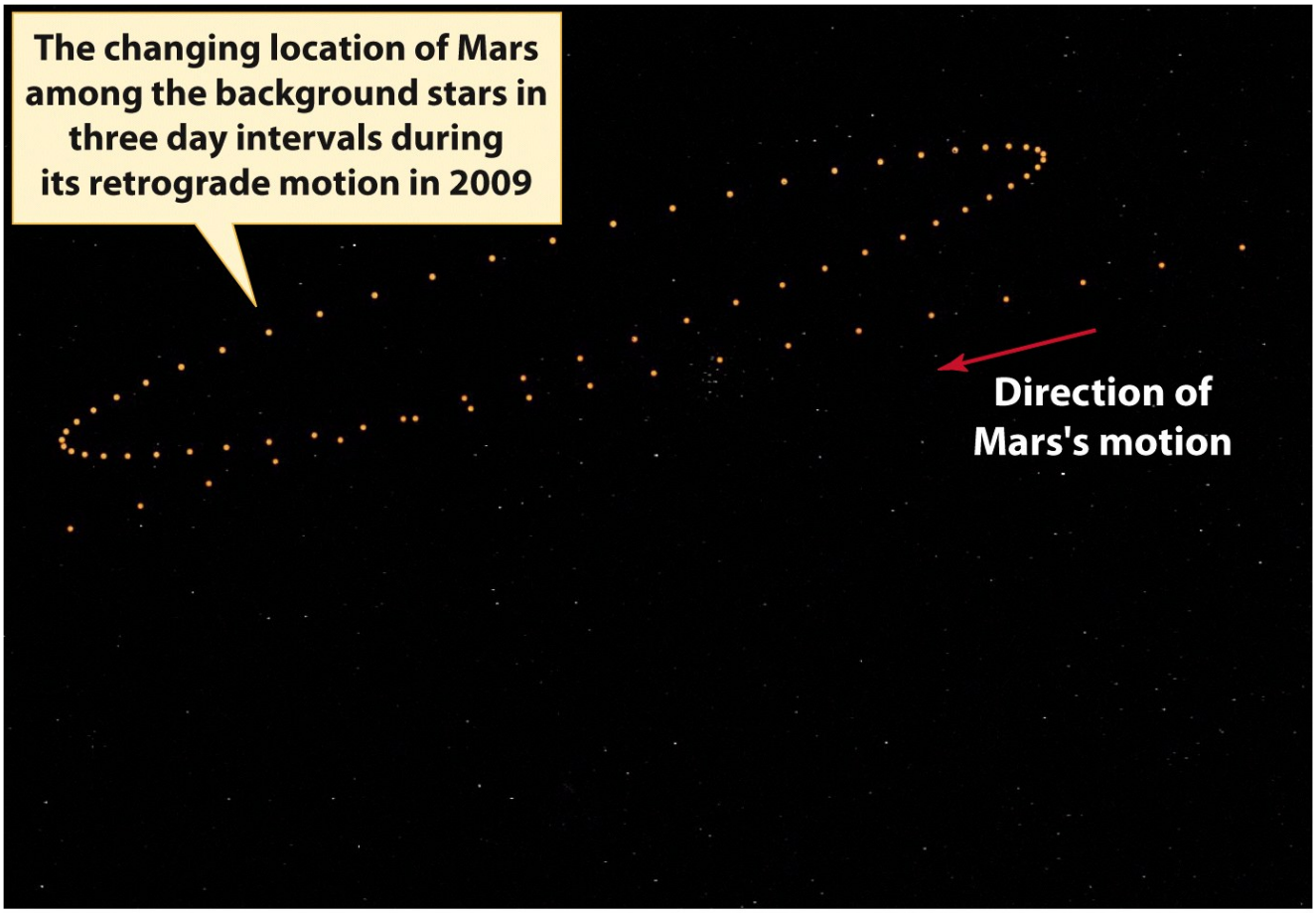


Figure 2-2a
Discovering the Universe, Eighth Edition

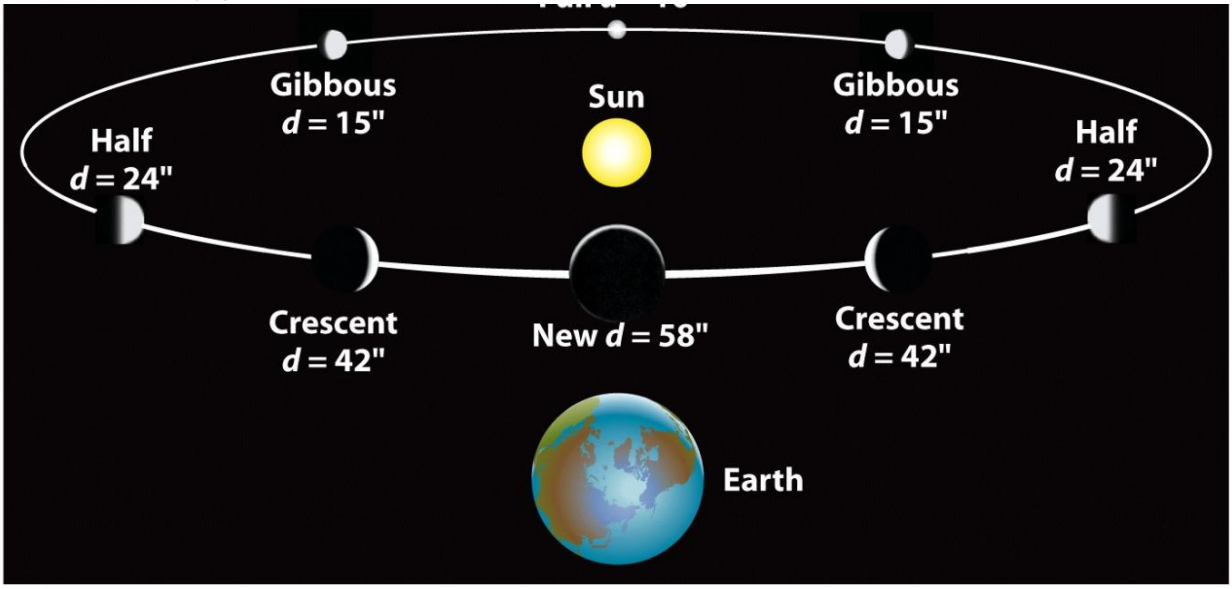


Figure 2-10
Discovering the Universe, Eighth Edition

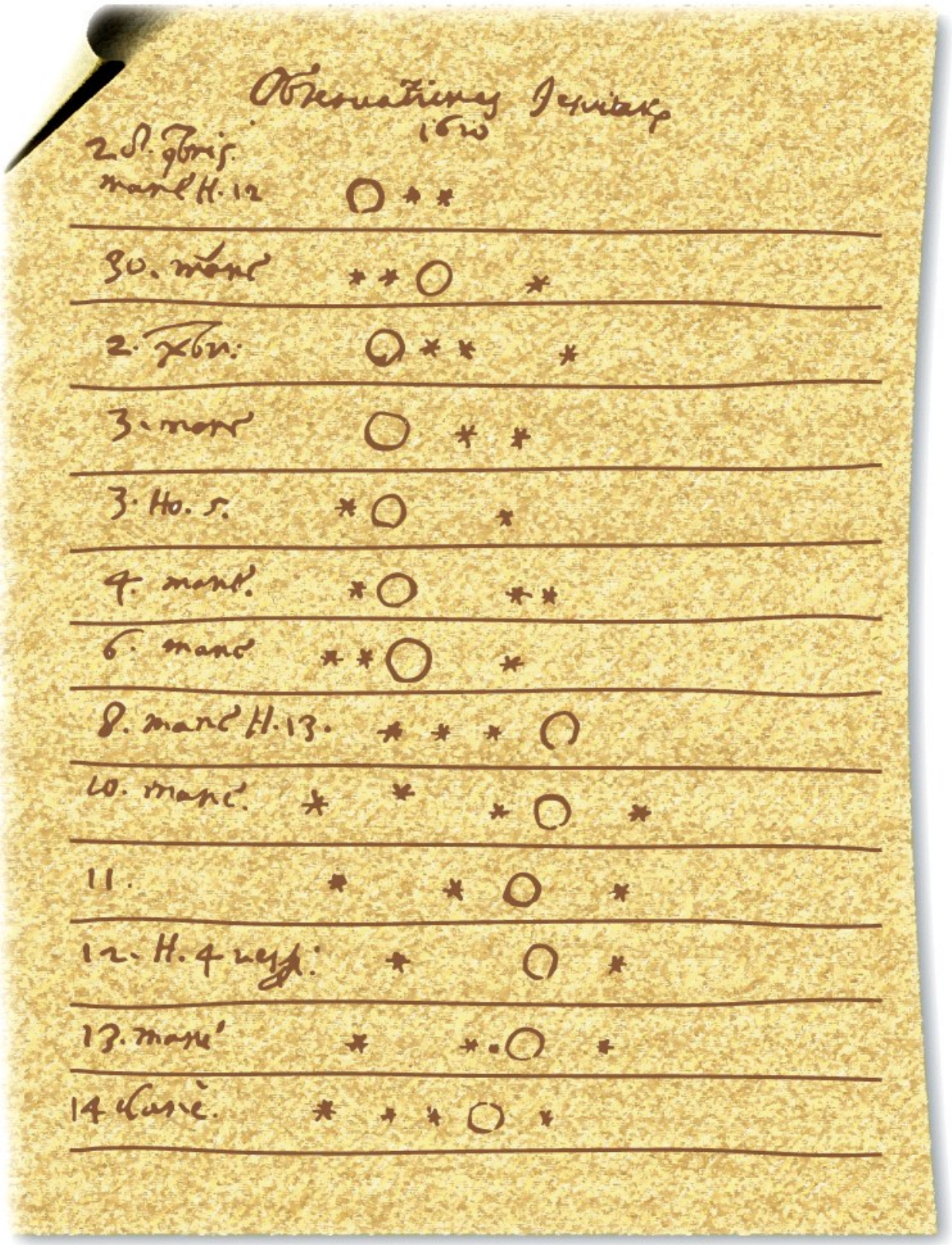
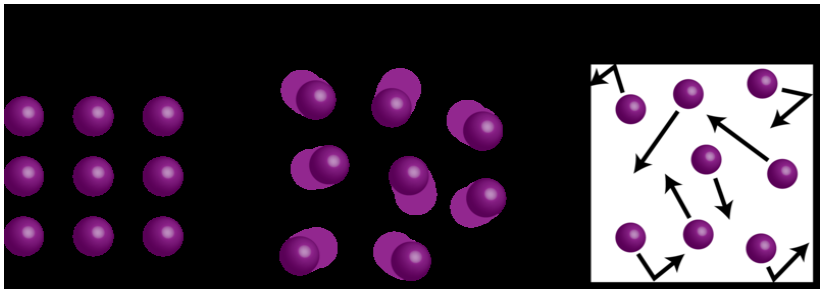


Figure 2-11a
Discovering the Universe, Eighth Edition

Scientific Theories

A scientific theory is a broad explanation that is widely accepted because it is supported by a great deal of evidence. An example is the kinetic theory of matter. According to this theory, all matter consists of tiny particles that are in constant motion. Particles move at different speeds in matter in different states. You can see this in Figure 1.4 and at the following URL: http://preparatorychemistry.com/Bishop_KMT_frames.htm. Particles in solids move the least; particles in gases move the most. These differences in particle motion explain why solids, liquids, and gases look and act differently. Think about how ice and water differ, or how water vapor differs from liquid water. The kinetic theory of matter explains the differences. You can learn more about this theory in the chapter States of Matter.



Kinetic Theory of Matter

Scientific Laws

Scientific laws are often confused with scientific theories, but they are not the same thing. **A scientific law is a statement describing what always happens under certain conditions in nature**. It answers "how" questions but not "why" questions. An example of a scientific law is Newton's law of gravity. It describes how all objects attract each other. It states that the force of attraction is greater for objects that are closer together or have more mass. However, the law of gravity doesn't explain why objects attract each other in this way. Einstein's theory of general relativity explains why. You can learn more about Newton's law of gravity and Einstein's theory in the chapter Forces.

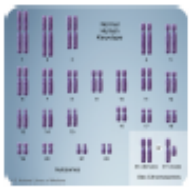
History of Science

People have wondered about the natural world for as long as there have been people. So it's no surprise that modern science has roots that go back thousands of years. The Table 1.1 describes just a few milestones in the history of science. A much more detailed timeline is available at the link below. Often, new ideas were not accepted at first because they conflicted with accepted views of the world. A good example is Copernicus' idea that the sun is the center of the solar system. This idea was rejected at first because people firmly believed that Earth was the center of the solar system and the sun moved around it.

TABLE 1.1: short caption

Date	Scientific Discovery
3500 BC  *Mesopotamian calendar*	Several ancient civilizations studied astronomy. They recorded their observations of the movements of stars, the sun, and the moon. We still use the calendar developed by the Mesopotamians about 5500 years ago. It is based on cycles of the moon.
600 BC  *Thales*	The ancient Greek philosopher Thales proposed that natural events, such as lightning and earthquakes, have natural causes. Up until then, people blamed such events on gods or other supernatural causes. Thales has been called the "father of science" for his ideas about the natural world.
350 BC  *Aristotle*	The Greek philosopher Aristotle argued that truth about the natural world can be discovered through observation and induction. This idea is called empiricism. Aristotle's empiricism laid the foundation for the methods of modern science.
400 AD to 1000 AD  *Early Chinese Seismograph*	When Europe went through the Dark Ages, European science withered. However, in other places, science still flourished. For example: • In North Africa, the scientist Alhazen studied light. He used experiments to test competing theories about light. • In China, scientists invented compasses. They also invented seismographs to measure earthquakes. They studied astronomy as well.

TABLE 1.1: (continued)

Date	Scientific Discovery
Mid-1500s to late 1600s  *Galileo*	The Scientific Revolution occurred in Europe. This was the beginning of modern Western science. Many scientific advances were made during this time. • Copernicus proposed that the sun, not Earth, is the center of the solar system. • Galileo improved the telescope and made important discoveries in astronomy. He discovered evidence that supported Copernicus' theory. • Newton proposed the law of gravity.
2001  *Human Chromosomes*	Many scientists around the world worked together to complete the genetic sequence of human chromosomes. This amazing feat will help scientists understand, and perhaps someday cure, genetic diseases.

Women and People of Color in Science

Throughout history, women and people of color have rarely had the same chances as white males for education and careers in science. But they have still made important contributions to science. The **Table** 1.2 gives just a few examples of their contributions to physical science. More contributions are described at these links:

- http://www.inventions.org/culture/science/women/index.html
- http://www1.umn.edu/ships/gender/giese.htm
- https://webfiles.uci.edu/mcbrown/display/faces.html
- http://library.thinkquest.org/20117/

TABLE 1.2: A diversity of people has contributed to physical science.

Contributor	Description
Marie Curie (1867-1934) 	Marie Curie was the first woman to win a Nobel Prize. She won the 1903 Nobel Prize in physics for the discovery of radiation. She won the 1911 Nobel Prize in chemistry for discovering the elements radium and polonium.

TABLE 1.2: (continued)

Contributor	Description
Lise Meitner (1878-1968) 	Lise Meitner was one of the scientists who discovered nuclear fission. This is the process that creates enormous amounts of energy in nuclear power plants.
Irene Joliot-Curie (1897–1956) 	Irene Joliot-Curie, daughter of Marie Curie, won the 1935 Nobel prize in chemistry, along with her husband, for the synthesis of new radioactive elements.
Maria Goeppert-Mayer (1906–1972) 	Maria Goeppert-Mayer was a co-winner of the 1963 Nobel prize in physics for discoveries about the structure of the nucleus of the atom.
Ada E. Yonath (1939–present) 	Ada E. Yonath was a co-winner of the 2009 Nobel prize in chemistry. She made important discoveries about ribosomes, the structures in living cells where proteins are made.

TABLE 1.2: (continued)

Contributor	Description
Shirley Ann Jackson (1946-present) 	Shirley Ann Jackson earned a doctoral degree in physics. She became the chair of the US Nuclear Regulatory Commission.
Ellen Ochoa (1958-present) 	Ellen Ochoa is an inventor, research scientist, and NASA astronaut. She has flown several space missions.

1.2 The Scope of Physical Science

Lesson Objectives

- Define physical science.
- Explain the relevance of physical science to everyday life.
- Describe examples of careers in physical science.

Lesson Vocabulary

- chemistry
- physical science
- physics

Introduction

Physical science covers a lot of territory. It's easier to describe by what it is not than by what it is. Basically, it's all science that is not life science.

Defining Physical Science

Physical science can be defined as the study of matter and energy. Matter refers to all the "stuff" that exists in the universe. It includes everything you can see and many things that you cannot see, including the air around you. Energy is what gives matter the ability to move and change. Energy can take many forms, such as electricity, heat, and light. Physical science can be divided into chemistry and physics. Chemistry focuses on matter and energy at the scale of atoms and molecules. Physics focuses on matter and energy at all scales, from atoms to outer space.

Chemistry

Chemistry is the study of the structure, properties, and interactions of matter. Important concepts in chemistry include physical changes, such as water freezing, and chemical reactions, such as fireworks exploding. Chemistry concepts can answer all the questions on the left page of the notebook in **Figure** 1.5. Do you know the answers?

Physics

Physics is the study of energy and how it interacts with matter. Important concepts in physics include motion, forces such as magnetism and gravity, and different forms of energy. Physics concepts can answer all the questions on the right page of the notebook in **Figure** 1.5.

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and the Points to Consider