

## INTRODUCTION

# PENDULUMS and LAWS OF NATURE

The ancient Greeks thought that lightning was a weapon thrown by the God Zeus when he was angry. The ancient Chinese believed that rain was a gift from the heavens, controlled by a mythical dragon called "Long," who could create prosperity or destruction. For many civilizations throughout history, the phenomena of nature were believed to be governed by the gods and other supernatural forces, often unpredictable and not obeying any human rhyme or reason.

Then in the seventeenth century, the great physicist Isaac Newton proposed his

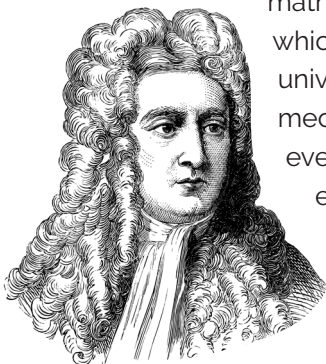
"mathematical laws of motion," which suggested that the universe is like a giant mechanical clock, with each event following a previous event in a completely predictable manner.

Furthermore, according to Newton's view and that of modern science,

everything in nature follows laws, which can be discovered by us human beings. Still, many people believe that some phenomena and events do not obey laws and lie beyond the reach of scientific understanding.

One of the first quantitative laws of nature came from the study of **pendulums** in the late sixteenth century. At that time, the Italian physicist Galileo found a quantitative relationship between the length of a pendulum and the time for it to make a complete swing (called its **period**).

It turns out that many phenomena in nature, like ocean tides and seismic waves in the earth, have pendulum-like behavior. In fact, all physical systems, when moved slightly from their most stable position, oscillate about that position like a pendulum. Thus pendulums not only demonstrate a quantitative law of nature but also have widespread application.



ISAAC NEWTON



GALILEO GALILEI

### KEY CONCEPTS AND VOCABULARY

**Simple harmonic motion:** vibration about an equilibrium position in which a restoring force is proportional to the displacement from equilibrium

**Period:** the time that it takes a complete cycle or wave oscillation to occur

**Amplitude:** the maximum displacement from equilibrium

**Pendulum:** a body suspended from a fixed point so as to oscillate freely under the influence of gravity

**Oscillation:** periodic motion