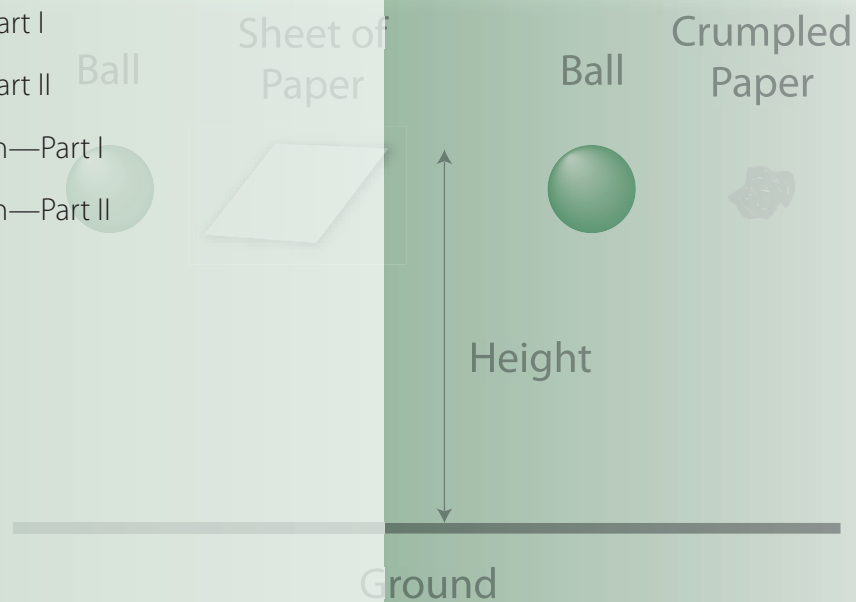


Kinematics

Kinematics

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Unit 1 Learning Outcomes

At the end of this unit students will be expected to:

Knowledge and Understanding

- identify the frame of reference for a given motion and to distinguish fixed and moving frames (325-7)
- use vectors to represent position, displacement, velocity, and acceleration (325-5)
- analyze and describe vertical motion using the principles of kinematics (116-2)
- analyze word problems, solve algebraically for unknowns, and interpret patterns in data (325-2)

Experimentation/Technological Applications

- identify and investigate questions that arise from practical problems/issues involving motion (212-1)

Lesson 1 Introduction

“That vast book which stands forever open before our eyes, the universe, cannot be read until we have learned the language and become familiar with the characters in which it is written.” — Galileo Galilei

In this lesson, we discuss what the study of physics encompasses, and briefly look at how it has developed from an ancient Greek philosophy into a modern science.

What is Physics?

In a poetic sense, physics can be viewed, as Galileo saw it, as the language of the universe.

In practical terms, however, physics is defined as the branch of science that studies the *physical* world. It stems from a need to understand our physical environment, and to explain why nature behaves as it does. Not surprisingly, the word *physics* is derived from the Greek word for *nature*.

Originally, the study of physics was a branch of what was termed “natural philosophy”. Theories were not based on physical evidence (i.e. experimental measurements), but rather on deep thought.

Today, physics is defined as *the study of matter and energy, and how they interact*. That is, it is the study of how objects behave in terms of *motion, forces, and energy*. Because these concepts are so basic to our understanding of the world, physics is considered to be the most fundamental of all the sciences.

The Branches of Physics

Physicists investigate objects as small as atoms and as large as galaxies. Because of this, the study of physics is divided into many different fields.

Generally speaking, the study of physics can be divided into two broad categories: *classical physics* and *modern physics*. *Classical physics* treats *matter* and

energy as *separate entities* and deals with objects in our everyday experience. It includes the study of motion (kinematics), and the forces that cause it (dynamics). Together, these form the branch we call *mechanics*. Classical physics also includes the study of electricity and magnetism, fluids, heat (thermal physics), sound, and light (optics). Note that all of these topics were under investigation by the end of the nineteenth century, hence the term “classical”.

New fields, which have developed since the scientific revolution at the turn of the twentieth century, are grouped into what is now termed *modern physics*. Some examples of these include the study of relativity, atomic structure (atomic physics), the nucleus (nuclear physics), elementary particles (elementary particle physics), and space (astrophysics). The term *quantum physics* refers specifically to the study of atoms and subatomic particles. Note that all of these topics treat *matter* and *energy* as different manifestations of the *same entity*.

Historical Background

The fascinating study of physics includes the story of many great scientists whose discoveries have led to our current understanding of the world. Many of our modern applications such as space travel, telecommunications, electronics, ultrasonic imaging, and lasers have developed from the discoveries of Galileo and Newton.