

# CHAPTER 1 FUNDAMENTALS OF SEMICONDUCTOR ELECTRONIC

## 1.1 Introduction

The field of electronics today has been dominated by Integrated Circuits (IC). Diodes and transistors are the basic components in the manufacturing of integrated circuits besides passive components such as resistors and capacitors. This means that an integrated circuit may perform operation which needed a large number of diodes, transistors and passive components. ICs are found in digital computers for its small size, low power consumption and high reliability. However, studying the characteristics and fundamentals of discrete electronics devices is still very important especially in the early years for the following reasons:

- a) In designing integrated circuits, knowledge and understanding of the physical properties of basic devices which form the entire circuit is needed to ensure high quality products.
- b) In many situations, a complex circuit still needs to incorporate ICs and discrete components to achieve the design objective as specified.

Therefore, this book will present the basic knowledge which needs to be garnered to enhance our understanding on discrete components such as diodes and transistors.

In this first chapter, we will begin by investigating the structure of energy bands in a solid which enables us to differentiate between insulators, semiconductors and metals. To arrive at this, we need to start by revising the energy levels in an atom. By the end of the chapter, readers should have an insight into the characteristics and behavior of semiconductors in order to understand the lessons on semiconductor devices in later chapters.

## 1.2 Electrons in Atoms

In the year 1911, Rutherford discovered that an atom consists of a nucleus which is made up of positively charged protons and negatively charged electrons.

### a) Simple Atoms.

A model of a simple atom consists of a nucleus with one proton; and one electron which moves in an orbit circling the nucleus. An example is the hydrogen atom (H).

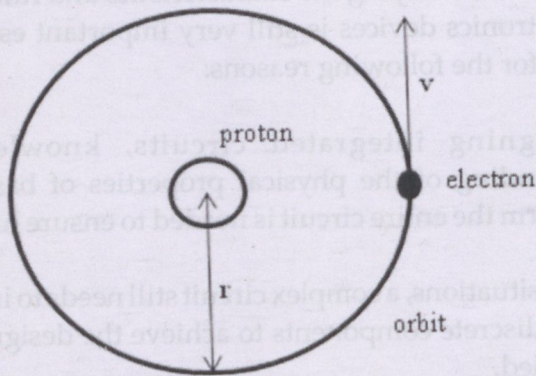


Figure 1.1: Model of a Simple Atom (H).