3.1: Introduction

In The Electric Field, we just scratched the surface (or at least rubbed it) of electrical phenomena by examining some of the basic properties of electric charge, fields, and forces. This chapter offers a complementary view of electrical phenomena focused on an energy-based approach.

We know that it takes energy to illuminate light bulbs (Fig. 3.1.1). If those light bulbs are connected to a battery and energy is conserved, potential energy must be stored in the battery. We would like to be able to explain this process more clearly and quantitatively.

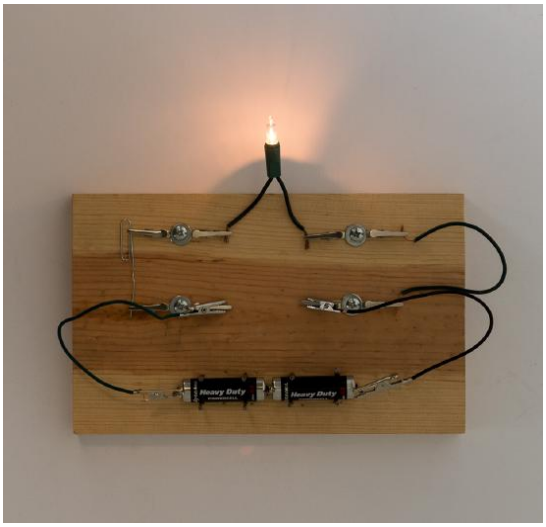

Figure 3.1.1: Batteries in a circuit used stored electric potential energy to illuminate a light bulb. [1]

We also know that electrical energy is transmitted cross-country through power lines and may even spontaneously jump from clouds to trees in the form of lightning (Fig. 3.1.2).

Figure 3.1.2: The energy released in a lightning strike is an excellent illustration of the vast quantities of energy that may be stored and released by an electric potential difference. In this chapter, we calculate just how much energy can be released in a lightning strike and how this varies with the height of the clouds from the ground. (credit: Anthony Quintano)

Two terms commonly used to describe electricity are its energy and voltage, which we show in this chapter are directly related to the potential energy in a system. Batteries are typically a few volts, the outlets in your home frequently produce 120 volts, and power lines can be as high as hundreds of thousands of volts. However, these terms are not interchangeable. A motorcycle battery, for example, is small and would not be very successful in replacing a much larger car battery, yet each has the same voltage. In this chapter, we examine the relationship between electrical energy and voltage (or, more formally, electric potential) and begin to explore some of the many applications of electricity.

References

1. Exploratorium. [Internet] CircuitWorkbench_DSC_4543_H_0.jpg. Exploratorium. Available from: Exploratorium Circuit Workbench. (CC-BY-NC-SA 4.0)
