

The Nature of Electricity

Electricity is a general term that includes a variety of phenomena resulting from the presence and flow of electric charge. These phenomena include lightning, static electricity, and the flow of electric current in a wire.

The word electricity is from the Latin word *electricus*, which means “amber-like.” *Electricus* was, in turn, derived from the Greek word *elektron*, meaning “amber,” because electrical effects were originally produced by rubbing amber.

Electrical effects have been studied for thousands of years, though advances in the science were not made until the 1600s. Practical applications of electricity did not become common until the late 1800s.

There have been a number of attempts to explain how electricity works. In this course, we will discuss two early models (see below) as well as the current model (in a later lesson).

Two-Fluid Theory

In 1733, Charles du Fay published a paper in which he proposed the existence of two types of electricity. He named them **vitreous** and **resinous** (later known as positive and negative, respectively).

According to du Fay’s model, an electrically **neutral** object had equal amounts of vitreous and resinous fluids. An object with more of one fluid than the other would be considered electrically **charged**.

He also noted the difference between conductors and insulators, calling them electrics and non-electrics for their ability to produce electrification through contact.

Finally, du Fay discovered that like-charged objects would repel each other and that unlike-charged objects would attract.

One-Fluid Theory

Shortly after du Fay’s work, Benjamin Franklin proposed that vitreous and resinous electricity were not different types of “electrical fluid,” but the same electrical fluid under different pressures.

According to Franklin’s model, a neutral object contains a certain natural amount of this electrical fluid. An object containing less than this natural amount would be considered negative. An object containing more than this natural amount would be considered positive.

Franklin was the first to use the terms positive and negative to describe electric charge.

Particle Model of Electricity

According to the particle theory of matter:

- all matter is composed of atoms
- atoms consist of three types of subatomic particles
 - protons
 - electrons
 - neutrons

The adoption of this model in the late 1700s, along with the discovery of the subatomic particles in the early 1900s, resulted in scientists developing a new theory about electricity. This new theory was called the **particle model of electricity**.

The particle model of electricity makes the following assertions:

1. There are two types of charged particles in every atom:
 - a) **Protons** are positively charged particles located in the nucleus.
 - b) **Electrons** are negatively charged particles that orbit around the nucleus.
2. Electric charge cannot be created or destroyed. This is known as the **law of conservation of charge**.
3. Negative charges are free to move around and between atoms. Positive charges are trapped in the nucleus and unable to move.
4. A **neutral** object has equal numbers of positive and negative particles.
5. A negatively charged object has more negative particles than positive ones. A positively charged object has more positive particles than negative ones.
6. Charge is transferred by contact.
 - a) Materials which allow charge to move easily are called **conductors**.
 - b) Materials which do not allow charge to move easily are called **insulators**.
7. Like charges repel; unlike charges attract. This is known as the **law of attraction and repulsion**.
8. Neutral objects are attracted to both positive and negative charges.