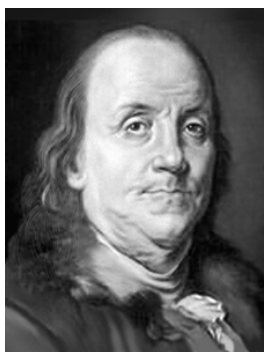


14A Benjamin Franklin

Benjamin Franklin overcame a lack of formal education to become a prominent businessman, community leader, inventor, scientist, and statesman. His study of “electric fire” changed our basic understanding of how electricity works.

An eye toward inventiveness



Benjamin Franklin was born in Boston in 1706. With only one year of schooling he became an avid reader and writer. He was apprenticed at age 12 to his brother James, a printer. The siblings did not always see eye to eye, and at 17, Ben ran away to Philadelphia.

In his new city, Franklin developed his own printing and publishing business. Over the years, he became a community leader, starting the first library, fire department, hospital, and fire insurance company. He loved gadgets and invented some of his own: the Franklin stove, the glass armonica (a musical instrument), bifocal eyeglasses, and swim fins.

‘Electric fire’

In 1746, Franklin saw some demonstrations of static electricity that were meant for entertainment. He became determined to figure out how this so-called “electric fire” worked.

Undeterred by his lack of science education, Franklin began experimenting. He generated static electricity using a glass rod and silk cloth, and then recorded how the charge could attract and repel lightweight objects.

Franklin read everything he could about this “electric fire” and became convinced that a lightning bolt was a large-scale example of the same phenomenon.

Father and son experiment

In June 1752, Franklin and his 21-year-old son, William, conducted an experiment to test his theory. Although there is some debate over the details, most historians agree that Franklin flew a kite on a stormy day in order to collect static charges.

Franklin explained that he and his son constructed a kite of silk cloth and two cedar strips. They attached a metal wire to the top. Hemp string was used to fly the kite. A key was tied near the string's lower end. A silk ribbon was affixed to the hemp, below the key.

Shocking results

It is probable that Franklin and his son were under some sort of shelter, to keep the silk ribbon dry. They got the kite flying, and once it was high in the sky they held onto it by the dry silk ribbon, not the wet hemp string. Nothing happened for a while. Then they noticed that the loose threads of the hemp suddenly stood straight up.

The kite probably was not struck directly by lightning, but instead collected charge from the clouds. Franklin touched his knuckle to the key and received a static electric shock. He had proved that lightning was a discharge of static electricity.

Those are charged words

Through his experiments, Franklin determined that “electric fire” was a single “fluid” rather than two separate fluids, as European scientists had thought.

He proposed that this “fluid” existed in two states, which he called “positive” and “negative.” Franklin was the first to explain that if there is an excess buildup of charge on one item, such as a glass rod, it must be exactly balanced by a lack of charge on another item, such as the silk cloth. Therefore, electric charge is conserved. He also explained that when there is a discharge of static electricity between two items, the charges become balanced again.

Many of Franklin's electrical terms remain in use today, including *battery*, *charge*, *discharge*, *electric shock*, *condenser*, *conductor*, *plus and minus*, and *positive and negative*.

Reading reflection

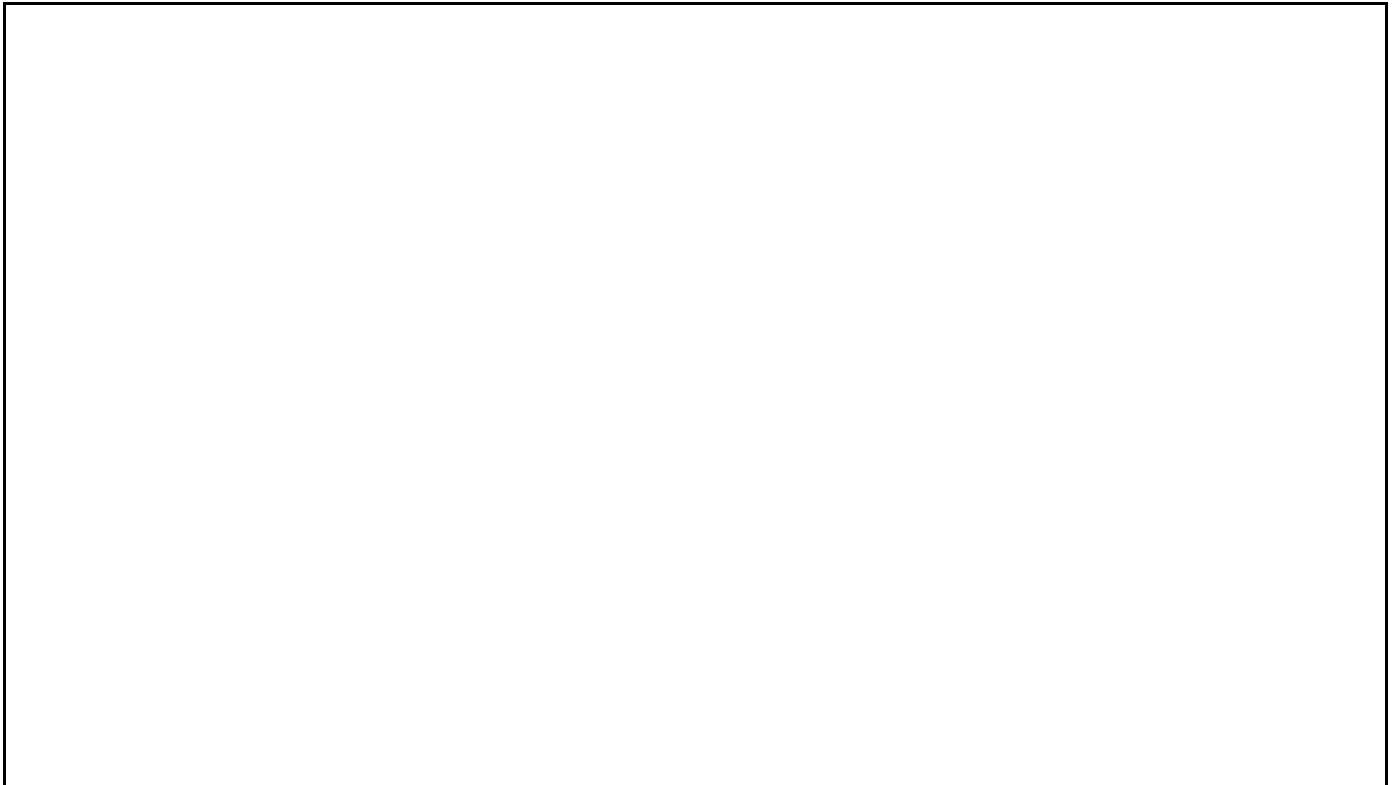
1. Although Ben Franklin had only one year of schooling, he became a highly educated person. Describe how Franklin learned about the world.

2. What hypothesis did Franklin test with his kite experiment?

3. Describe the results and conclusion of Franklin's kite experiment.

4. Franklin's kite experiment was dangerous. Explain why.

5. Silk has an affinity for electrons. When you rub a glass rod with silk, the glass is left with a positive charge. Make a diagram that shows the direction that charges move in this example. Illustrate and label positive and negative charges on the silk and glass rod in your diagram. Note: Show the same number of positive and negative charges in your diagram.



6. **Research:** Among Franklin's many inventions is the lightning rod. Find out how this device works, and create a model or diagram to show how it functions.