



17.4 Michael Faraday

Despite little formal schooling, Michael Faraday rose to become one of England's top research scientists of the nineteenth century. He is best known for his discovery of electromagnetic induction, which made possible the large-scale production of electricity in power plants.

Reading his way to a job



Michael Faraday was born on September 22, 1791, in Surrey, England, the son of a blacksmith. His family moved to London, where Michael received a rudimentary education at a local school.

At 14, he was apprenticed to a bookbinder. He enjoyed reading the materials he

was asked to bind, and found himself mesmerized by scientific papers that outlined new discoveries.

A wealthy client of the bookbinder noticed this voracious reader and gave him tickets to hear Humphry Davy, the British chemist who had discovered potassium and sodium, give a series of lectures to the public.

Faraday took detailed notes at each lecture. He bound the notes and sent them to Davy, asking him for a job. In 1812, Davy hired him as a chemistry laboratory assistant at the Royal Institution, London's top scientific research facility.

Despite his lack of formal training in science or math, Faraday was an able assistant and soon began independent research in his spare time. In the early 1820s, he discovered how to liquefy chlorine and became the first to isolate benzene, an organic solvent with many commercial uses.

The first electric motor

Faraday also was interested in electricity and magnetism. After reading about the work of Hans Christian Oersted, the Danish physicist, chemist, and electromagnetist, he repeated Oersted's experiments and used what he learned to build a machine that used an electromagnet to cause rotation—the first electric motor.

Next, he tried to do the opposite, to use a moving magnet to cause an electric current. In 1831, he succeeded. Faraday's discovery is called *electromagnetic induction*, and it is used by power plants to generate electricity even today.

The Faraday effect

Faraday first developed the concept of a field to describe magnetic and electric forces, and used iron filings to demonstrate magnetic field lines. He also conducted important research in electrolysis and invented a voltmeter.

Faraday was interested in finding a connection between magnetism and light. In 1845 he discovered that a strong magnetic field could rotate the plane of polarized light. Today this is known as the Faraday effect.

A scientist's public education

Faraday was a teacher as well as a researcher. When he became director of the Royal Institution laboratory in 1825, he instituted a popular series of Friday Evening Discourses. Here paying guests (including Prince Albert, who was Queen Victoria's husband) were entertained with demonstrations of the latest discoveries in science.

A series of lectures on the chemistry and physics of flames, titled "The Natural History of a Candle," was among the original Christmas Lectures for Children, which continue to this day.

Named in his honor

Faraday continued his work at the Royal Institution until just a few years before his death in 1867. Two units of measure have been named in his honor: the farad, a unit of capacitance, and the faraday, a unit of charge.



Reading reflection

1. What did Michael Faraday do to get a job with Humphry Davy? Why was this effort important in getting Faraday started in science?
2. Research benzene and list two modern-day commercial uses for this chemical.
3. Based on the reading, define electromagnetic induction.
4. In your own words, describe the Faraday effect. In your description, explain the term “polarized light.”
5. How did Faraday contribute to society during his time as the director of the Royal Institution laboratory?
6. Name two ways in which Faraday’s work affects your own life in the twenty-first century.
7. Imagine you could go back in time to see one of Faraday’s demonstrations. Explain why you would like to attend one of his demonstrations.
8. **Activity:** Use iron filings and a magnet to demonstrate magnetic field lines, or prepare a simple demonstration of electromagnetic induction for your classmates.