

Discovering Electricity

Discussion Questions:

- 1) Where did the name 'electricity' come from?
- 2) How was electricity discovered?
- 3) Which scientists are famous for their contributions in discovering electricity?



Electricity, The Long Road To Understanding

People have studied the natural world for thousands of years.

Phenomenon such as magnetism and static electricity were observed for many hundreds of years before scientists began to understand how to generate electricity.

The path to understanding electricity was a long and complicated one. Each scientist expanded on the work of those who came before. Many names have been all but forgotten but some are remembered as leaders in their field of scientific discovery.

Many creative thinkers and inventors were responsible for discovering how to create and use the power of electricity. Imagine how different our world would be without their valuable scientific discoveries!



The Discovery of Static Electricity

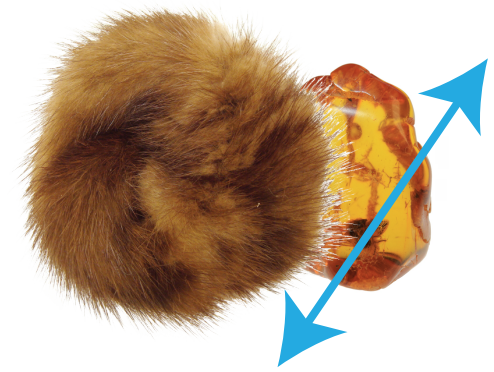
Thales of Miletus

(c. 620 BCE - c. 546 BCE)

Thales was a Greek philosopher from Miletus in Ancient Greece. In about 585 BCE he described his observations of the natural phenomenon that we call static electricity.

He discovered that if he rubbed a piece of amber (called *ilektron* in ancient Greek) with a piece of fur then the amber would attract light objects such as feathers.

It took some time before anyone was able to explain the principles behind this phenomenon.



A piece of amber (fossilised tree resin) rubbed with fur



Amber attracts feathers due to static charge

Where did the name electricity come from?

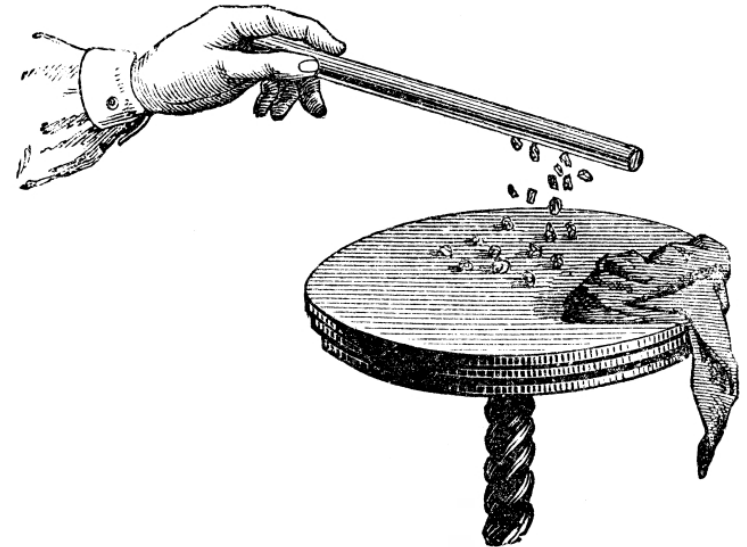
William Gilbert (1544 - 1603)

William Gilbert was an English physician and scientist. He was the first scientist to describe magnetism and he was the first to apply the latin word 'electricus' when describing the phenomenon of static electricity.

A unit of measurement for magnetic potential was named *Gilbert* after him.

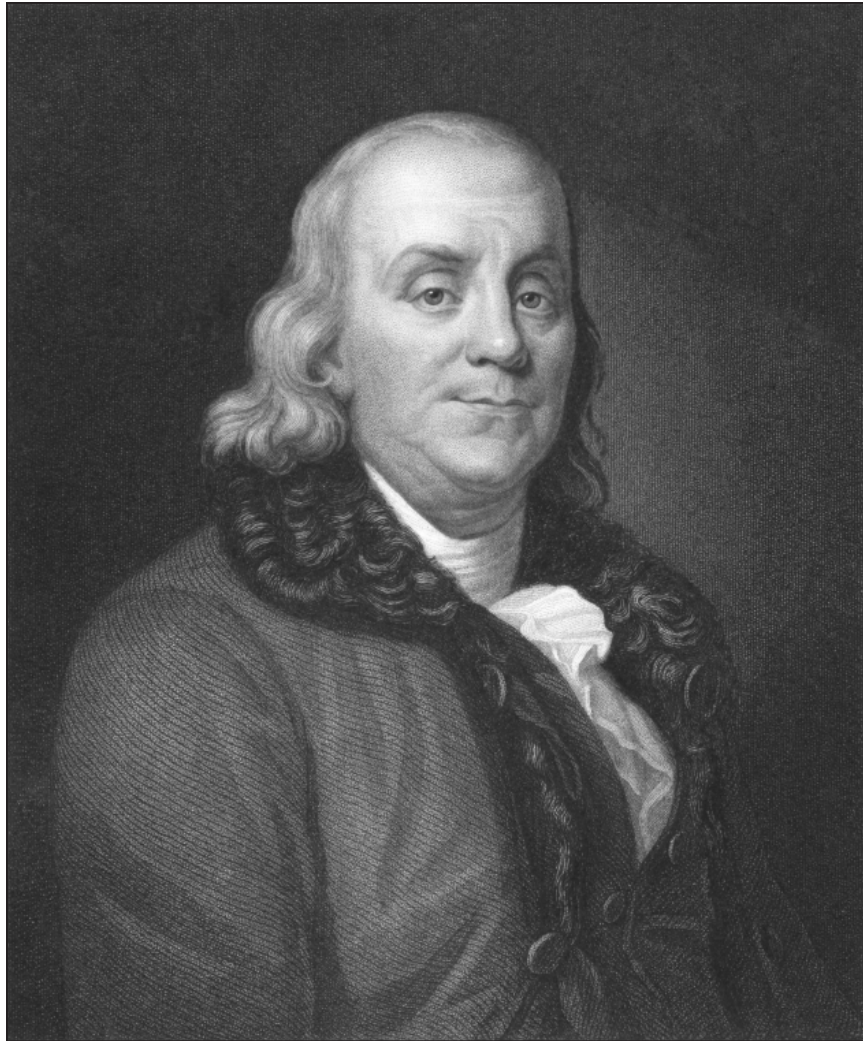
Thomas Browne (1605 - 1682)

Thomas Browne was a scientist and philosopher who wrote many books about his observations of the natural world. He expanded on Gilbert's work and applied the word 'electricity' to describe static electricity.



Benjamin Franklin

(1706-1790)

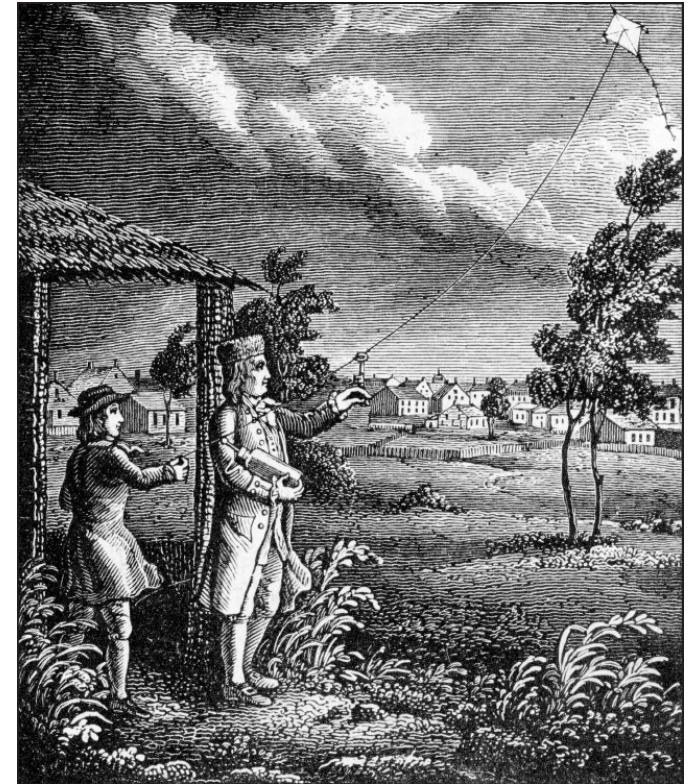


Benjamin Franklin was a writer, a civic leader and a diplomat. He was also a scientist and an inventor.

Study***ladder***

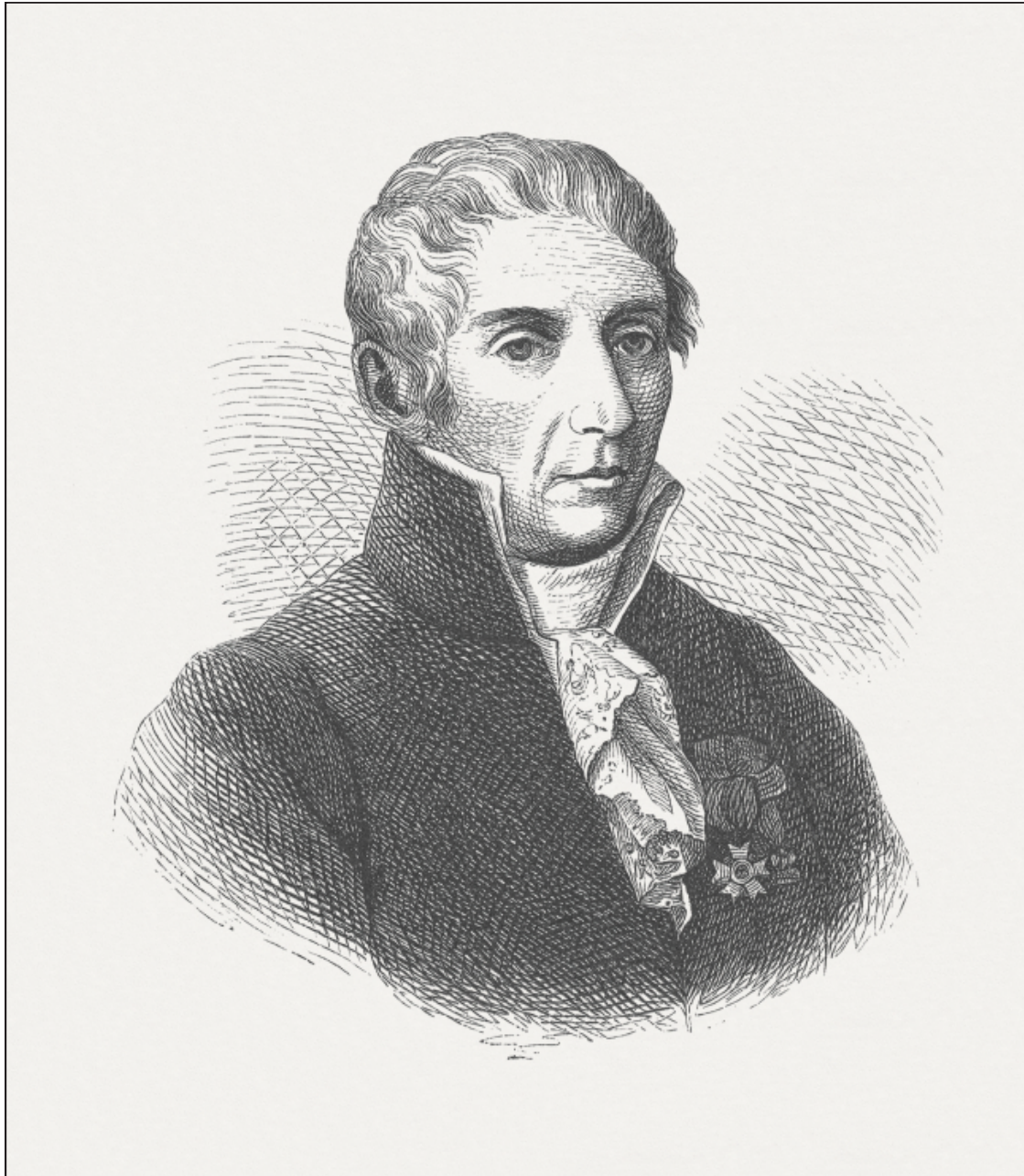
Benjamin Franklin was the first to suggest that lightning was in fact electricity. In 1750 he proposed an experiment to prove this by flying a kite with a key attached to it in an electrical storm. The idea was that the electric charge would pass through the wet string of the kite to the key. The electric charge could then be collected in a Leyden Jar, which was an early form of battery. Of course, this kind of experiment would be very dangerous. You should never fly a kite in an electrical storm!

In 1749 he invented the lightning rod. The metal rod sits high on the roof and is connected to the ground with an attached wire. When a lightning strike occurs the rod directs the current harmlessly to the ground. Benjamin Franklin's invention is still used today.



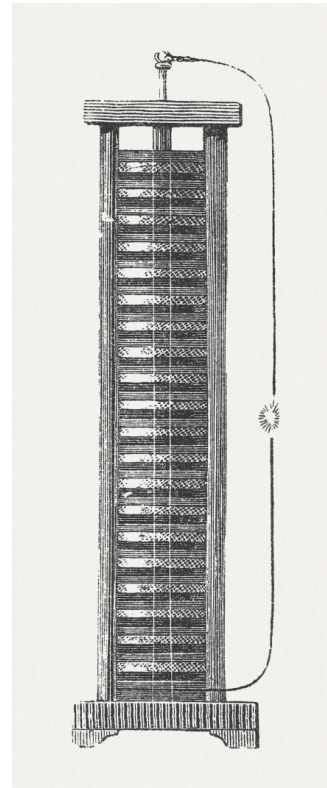
Alessandro Volta

(1745 - 1827)



Alessandro Volta was an Italian physicist and chemist. He was the first to create an electric field chemically. His invention, the Voltaic Pile, was created in 1799 and it was the first electrochemical cell.

Today, the potential energy of batteries, measured in volts (V) is named after Alessandro Volta.



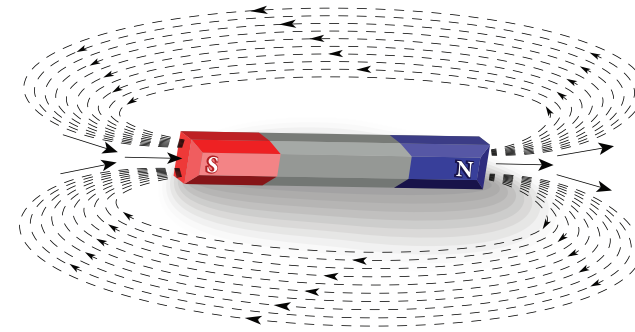
Voltaic Pile



A modern 1.5 Volt cell

Hans Christian Ørsted

(1777 - 1851)



Magnetic field

Magnets have an invisible force field around them.

In 1820 Hans Christian Ørsted discovered that a compass needle was deflected from true north when placed near a voltaic pile that was active. When the voltaic pile was disconnected the magnetic field disappeared.

His experiments proved that electric current produces a magnetic field when it runs through a wire.

André-Marie Ampère

(1775-1836)

Ampère was a French physicist and mathematician who was one of the founders of a new science that he named 'electrodynamics', which is called electromagnetism today.

In 1820 he discovered that a magnetic attraction or repulsion existed between two wires carrying current, depending on the direction of the flow.

He developed a mathematical theory about the relationship between electricity and magnetism and his findings became known as Ampère's Circuital Law.

Ampère proposed that charged electromagnetic molecules moving within a conductive material were responsible for electricity and magnetism. Today we know that these charged particles are electrons.



In 1881, the international standard unit for electric current was named ***ampere*** to honour his contributions to science in the field of electromagnetism.

Georg Ohm

(1789 - 1854)

Georg Ohm was a German physicist and mathematician who is remembered for his studies of electric circuits.

He experimented with passing current through long and short wires and wires of various thicknesses. He concluded that the current varies depending on the resistance of the wire. The greater the resistance the lower the current and vice versa. His theory became known as Ohm's Law.

The international standard unit for electric resistance, the ***ohm***, was named after him.



Michael Faraday

(1791-1867)



Michael Faraday was a British chemist and physicist who experimented with electromagnetism and electrochemistry during the 1830s.

He found that an electric current could be produced when a copper disc was rotated between the poles of a magnet. His work in the field of electromagnetic induction led to the production of the transformer and the generator.

A modern electric motor (or generator) works using the same principle. Metal wire is coiled around a metal rod. This rod spins within the field of strong magnets. Electric current is generated within the field and is pushed along wires.

The *faraday*, a unit of electrical charge, is named after him, as is the *farad*, a unit of capacitance.

Thomas Edison

(1847 - 1931)

Thomas Edison was an American inventor and business man. His famous inventions included the phonograph in 1877 (this was the first machine that could record sound and play it back) and the first motion picture camera called a kinetograph which was patented in 1897. But it is the incandescent electric light bulb that he invented in 1879 for which he is most well known.

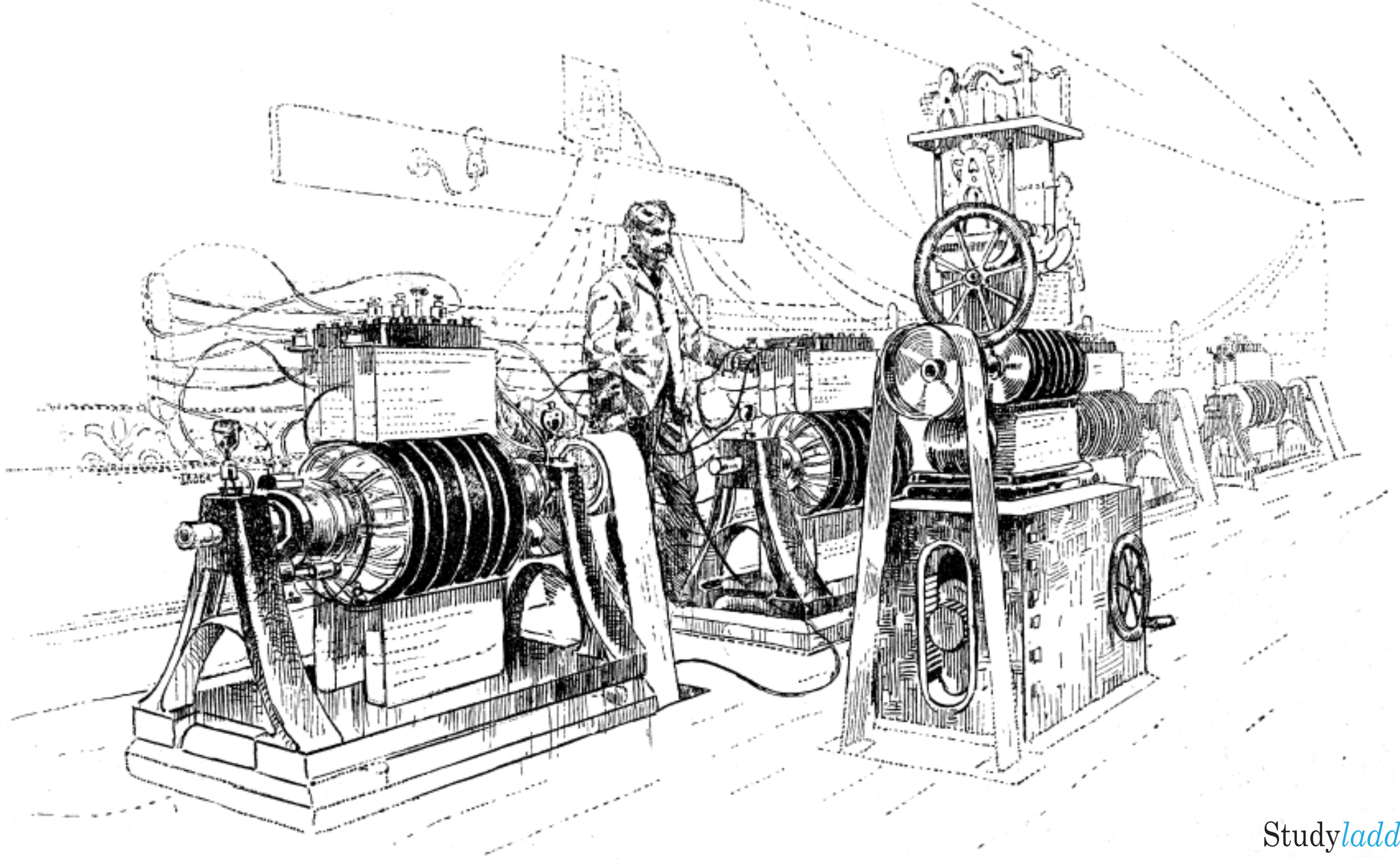
Many others had tried to make electric light bulbs but they were either too expensive to make, not long lasting enough, or drew too much current and broke easily. Edison's light bulb was the first long lasting bulb that could be produced cheaply for a commercial market.

After Edison invented the first commercially viable light bulb he realised that his invention could radically change people's lives.



He set up the Edison Illuminating Company in 1880 and began setting up DC (direct current) power supply systems for lighting areas in the city of New York.

Electric Companies began supplying power to the community for street lighting, streetcars, electric motors in factories and home lighting. The disadvantage of direct current (DC) was that the voltage decreased with distance so electricity could only be supplied to devices that were in close proximity to the generator.



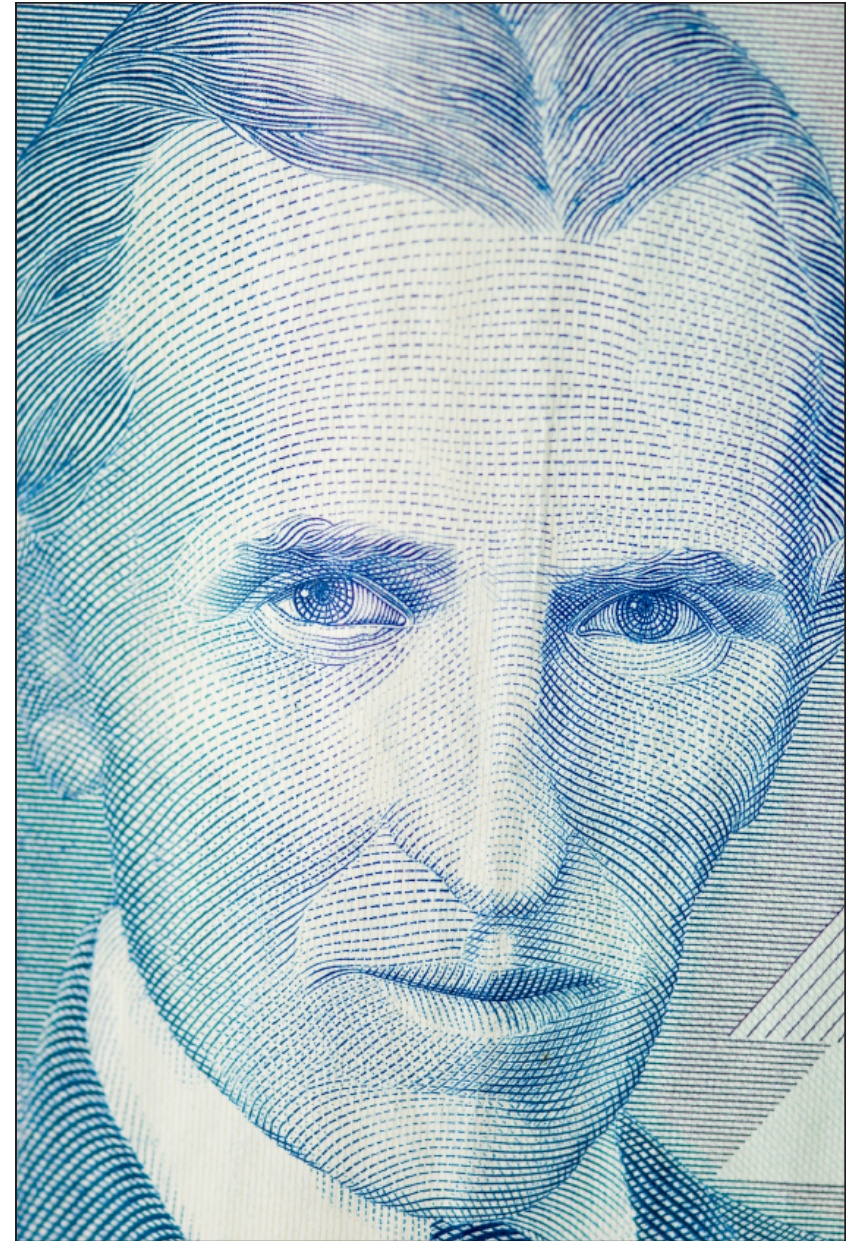
Nikola Tesla

(1856 - 1943)

Nikola Tesla was a Serbian born inventor and electrical and mechanical engineer who is best known for his inventions that harnessed alternating current (AC). In 1887 he added to the work of his contemporaries and developed the first commercially viable alternating current induction motor.

Tesla is also known for his experiments with electricity. He invented the Tesla Coil which was used in wireless telegraphy until the 1920s.

Tesla has a unit of measurement for magnetic inductivity, the *tesla*, named after him.



Transformers and The Distribution of Electric Power

William Stanley
(1858 - 1916)



The main electricity supply companies in New York held opposing views on the most effective way to produce electricity for the wider community. Thomas Edison's company believed that direct current was the best method for electricity distribution. George Westinghouse's company believed that alternating current was best. Eventually alternating current became the preferred method of supply.

Scientists knew that high voltage electricity could travel a greater distance but there was no practical way to change the voltage up or down for effective distribution of electricity.

Ottó Bláthy, Miksa Déri, Károly Zipernowsky were the first to build a device to transform voltage to different levels but their design was costly to make. Many scientists worked on this problem but it was William Stanley who built the first commercially reliable transformer in 1886.

The invention of the transformer marked the beginnings of modern electric power distribution.