

WHAT IS ELECTRICITY?

- *Electricity* - most sophisticated form of energy in use in the world today
- Primary way to meet growing demand - build power plants or repower old plants to raise capacity
- Electricity is the flow of electrons (current) when an energy potential (voltage) is applied

THE BEGINNINGS OF ELECTRICITY

- ***Believe it or not*** - electricity did not begin when Benjamin Franklin flew his kite during a rainstorm, or when the first incandescent lamp glowed.
- ***Electricity has always been with us*** - electricity exists in nature, e.g. lightning (flow of electrons between the ground and clouds) and shock when you touch something (static electricity).
- ***Magnus (900 BC)*** - Greek shepherd walks across a field of black stones which pulls the iron nails from his sandals.
- ***Thales of Miletus (600 BC)*** - ancient Greek philosopher, discovers that when amber is rubbed against cloth, lightweight objects will stick to it - static electricity. “Elektron” is the Greek word for amber.

- The following slides will show the many but important little discoveries, theories and writings that laid down the basic foundation of electricity and magnetism.
- Only the important discoveries are included to show the progression from the initial phenomena of natural magnets and static electricity to the more complex discovery – the battery, electro magnets, electric generator and electric motor, transformer, capacitor, etc.

HISTORY OF ELECTRICITY & MAGNETISM

The pioneering work of Benjamin Franklin, Alessandro Volta and Michael Faraday on electricity and magnetism laid the foundation for the development of the electric motor, transformer and generator.

Franklin



Discovered
electricity -
lightning

Volta



Invented
world's 1st
battery

Faraday



Electro-magnetic
rotation &
induction

HISTORY OF ELECTRICITY & MAGNETISM (2)

- **1269** – **Petrus Peregrinus** discovers that natural spherical magnets (lodestones) align needles longitudinally.
- **1600** – **William Gilbert** discovers that the earth is a giant magnet just like the lodestones of Peregrinus, explaining how compasses work; describes static electricity.
- **1620** – **Niccolo Cabeo** discovers that electricity can be repulsive as well as attractive.
- **1630** – **Vincenzo Cascariolo** discovers fluorescence.
- **1675** – **Otto von Guericke** invents the first static electric generator.
- **1729** – **Stephen Gray** shows that electricity can be transferred from place to place with conducting wires.
- **1733** – **Charles du Fay** discovers that electricity comes in two kinds: resinous (-) and vitreous (+).

HISTORY OF ELECTRICITY & MAGNETISM (3)

- **1745** – **Georg Von Kleist** invents the Leyden jar, or capacitor; nearly kills his friend.
- **1748** – **Sir William Watson** uses an electrostatic machine and a vacuum pump to make the first fluorescent bulb.
- **1750** – **John Michell** discovers that the 2 poles of a magnet are equal in strength and the force is inverse the distance².
- **1752** – **Benjamin Franklin** discovers that atmospheric electricity that causes lightning is similar to the electrostatic discharge on a Leyden Jar while flying a kite in a storm.
- **1759** – **Francis Aepinus** discovers charging by induction.
- **1775** – **Henry Cavendish** invents the concept of capacitance and resistance (published later by Lord Kelvin in 1879).
- **1780** – **Luigi Galvani** causes dead frog legs to twitch with static electricity and contact with dissimilar metals.

HISTORY OF ELECTRICITY & MAGNETISM (4)

- **1780 - Alosio Galvani** invents the first current generator.
- **1785 – Charles Coulomb** concludes a study on the attraction and repulsion between charged bodies.
- **1800 – Alessandro Volta** invents the world’s first electric battery – “voltaic pile”.
- **1800 - William Nicholson** and **Anthony Carlisle** discover that water may be separated into hydrogen and oxygen using Volta’s pile (electrolysis).
- **1812 - Sir Humphery Davy** makes the first electric arc when electric current heats metal strips to incandescence, the beginnings of the light bulb.
- **1820 – Hans Oersted** discovers electromagnetism when an electric current in a wire causes a compass needle to orient itself perpendicular to the wire.

HISTORY OF ELECTRICITY & MAGNETISM (5)

- **1820 – Andre Marie Ampere** shows that parallel currents attract each other and that opposite currents attract (?); also publishes by 1825 his collected results on magnetism which summed up the cardinal formulas of *electrodynamics*.
- **1822 – Thomas Johann Seebeck** discovers thermoelectric effect by showing that a current will flow in a circuit made of dissimilar metals if there is a temperature difference between the metals (thermocouple).
- **1826 – Georg Simon Ohm** establishes the Ohm's law $V=IR$ which developed the idea that voltage is the driver of electric current, just like temperature (heat) and pressure (flow).
- **1831 – Michael Faraday** discovered electromagnetic induction when changing currents in one circuit will induce currents in neighboring circuit – principle of electric transformer and generator.

HISTORY OF ELECTRICITY & MAGNETISM (6)

- **1832 - John Henry** discovers that an electric current may be produced in a conductor that is disconnected from a battery - principle of self-induction.
- **1834 - Michael Faraday** discovers self inductance.
- **Joseph Henry** and **Michael Faraday** are both credited with building the first experimental electric motors. **Joseph Henry** invented the first electric bell and electromagnetic telegraph.
- **1834 - Jean Charles Peltier** discovers the flip side of Seebeck's thermoelectric effect - current driven in a circuit made of dissimilar metals causes the different metals to be at different temperatures.
- **1834 - Emil Lenz** formulates his Lenz's Law for determining the direction of Faraday's induced currents:

HISTORY OF ELECTRICITY & MAGNETISM (7)

- **1838 - Michael Faraday** shows that the effects of induced electricity in insulators are analogous to induced magnetism in magnetic materials.
- **1839 - William Robert Grove** invents the first fuel cell.
- **1840 - Samuel Morse** invents the telegraph, the first of the great uses of electricity - communications
- **1841 - James Prescott Joule** shows that energy is conserved in electrical circuits involving current flow, thermal heating and chemical transformations (conservation of energy).
- **1864 - James Clark Maxwell** discovers that magnetic fields can be induced by changing electric fields.
- **1866 - Werner Von Siemens** designs electrical generator powered by electromagnets that can start itself using residual magnetism left on the electromagnet (self-excited generator).

HISTORY OF ELECTRICITY & MAGNETISM (8)

- **1869 – Zenobe Theophile Gramme** designs the first high voltage DC generator practical for mass production. Later in 1873 at Vienna Exhibition, he discovers that his generator may double as an electric motor.
- **1873 - James Clark Maxwell** publishes *A Treatise on Electricity and Magnetism*, the keystone work in the unification of electricity and magnetism combining electric, magnetic and optical phenomena to be the result of electromagnetic waves.
- **1876 - Thomas Watson and Alexander Graham Bell** work together to complete the first telephone.
- **1877 - Thomas Edison** invents the phonograph.
- **1879 - Werner Von Siemens** shows first electric locomotive.
- **1887 - Nikola Tesla** introduces the first alternating current (AC) motor; previously, motors were direct current (DC).