Michael Faraday

Outline

→ Introduction
→ Early life
→ Research work
→ Later years
→ Influence
→ Conclusion

Introduction

→ One of the most marvelous scientists in the 19th century
→ Rose from obscure origin
→ Diligent and intelligent
→ Became not only a great chemist, but also a renowned physicist
→ Most influential breakthroughs were in electromagnetism

Early Life

→ Born in Newington, England in 1791
→ One of the four children in a working class family
→ Only some basic education from a church school
→ Had been apprenticed to a London bookbinder since 14
→ Took the opportunity to read some of the books

Early Life (continued)

→ Developed an interest in science
→ Saved money to buy some apparatus for his first experiment
→ Began to attend some lectures on science
→ Decided to quit trade and pursue science at the end of his apprenticeship

Big Change

→ Wrote to Sir Humphry Davy
→ Chemist at the Royal Institution
→ Begged for a job and sent along with a bound volume of notes, which he had taken at Davy’s lectures
→ Impressed by the boy’s zeal, Davy made Faraday his laboratory assistant in 1813
Big change (continued)

- Since then (21 year-old), drank in knowledge from Davy
- Finished his second apprenticeship in 1820
- Great accomplishment for a man who was almost completely self-educated originally

Early Research

- Mainly with chemical problems
- In 1820, produced $\text{C}_2\text{Cl}_4$ and $\text{C}_2\text{Cl}_6$
- In 1823, discovered a method of liquefying chlorine and other gases
- In 1825, successfully isolated a new compound, benzene

Influence

- Knowledge of electricity before Faraday
  - Static electricity (1600)
  - Leyden Jar (1746)
  - Voltaic Pile - DC (1800)
  - Early research on electrolysis (1806)
  - Nobody knew the incredible power that electricity could provide

Significant Breakthroughs in Electricity and Magnetics

- Three important inventions
  - Motor (1821)
  - Transformer (1831)
  - Generator (1831)
- How could he make it?
  - Books, Lectures & Experiments
  - Inspiration + Originality

Invention of Motor

- Oerstead discovered the deflection of a magnet upon an electric current flowed (1820)
- Inspired by Wollaston’s idea of producing a reciprocal effect
- Successfully constructed a model in which a wire would rotate around a magnet (1821)

His Research on Current Induction

- The first scheme
- The second scheme (Transformer)
- The third scheme (magnetic force line)
- Disk dynamo
Michael Faraday

Other Contributions

- Stated law of electrolysis, linked chemistry and electricity (1833)
- Explained phenomenon of capacitance (1835)
- Discovered the Magnetization of light (1845)
- Believed that magnetism and light are two forms of electromagnetic radiation
- Was supported by Maxwell ten years later
- Indirect result: the invention of radio

Later life

- Was given many honors, including:
  - An offer to become the president of the British Royal Society
  - An award of knighthood
  - However, a humble scientist as he was, he turned down those offers
  - The declining mental powers in 1855
  - Ceased researching
  - Continued as a lecturer for another six years
- Died on August 26, 1867

Faraday’s breakthroughs propelled our society to a new level of knowledge

- We use motor in thousands of applications: disk drive, video machine, fan, pump, washing machine, refrigerator, air conditioner...
- We need generator to produce electricity
- We need transformer for long-range electricity delivery and in some devices
- Those inventions compose the frame of our electric world

What if a Worldwide Blackout?

- Passengers, would be trapped, in the subway, and, elevator
- Doctors, would have trouble to operate, surgeries
- Airports, would not be able to regulate the airplanes
- Our cities, would fall into, darkness, all night
- All the communications, would be interrupted.
  - no radio, no TV, no telephone, and no Internet
- Manufactures, would have, to stop production
- Modern farms, have to, stop using, power

Conclusions

- A world without electricity is almost inconceivable to the modern mind
- The use of electricity completely permeates the modern world
- It is largely due to Faraday’s ingenious creations

Michael Faraday Was

- A pioneering scientist and magnificent thinker
  - When his work led him to a field that he did not know much about, or even nobody knew much about, he made it his business to learn
- A man of character and integrity
  - He did not like to vaunt his fruitful breakthroughs, which greatly change our world
- Worth to be imitated by our students