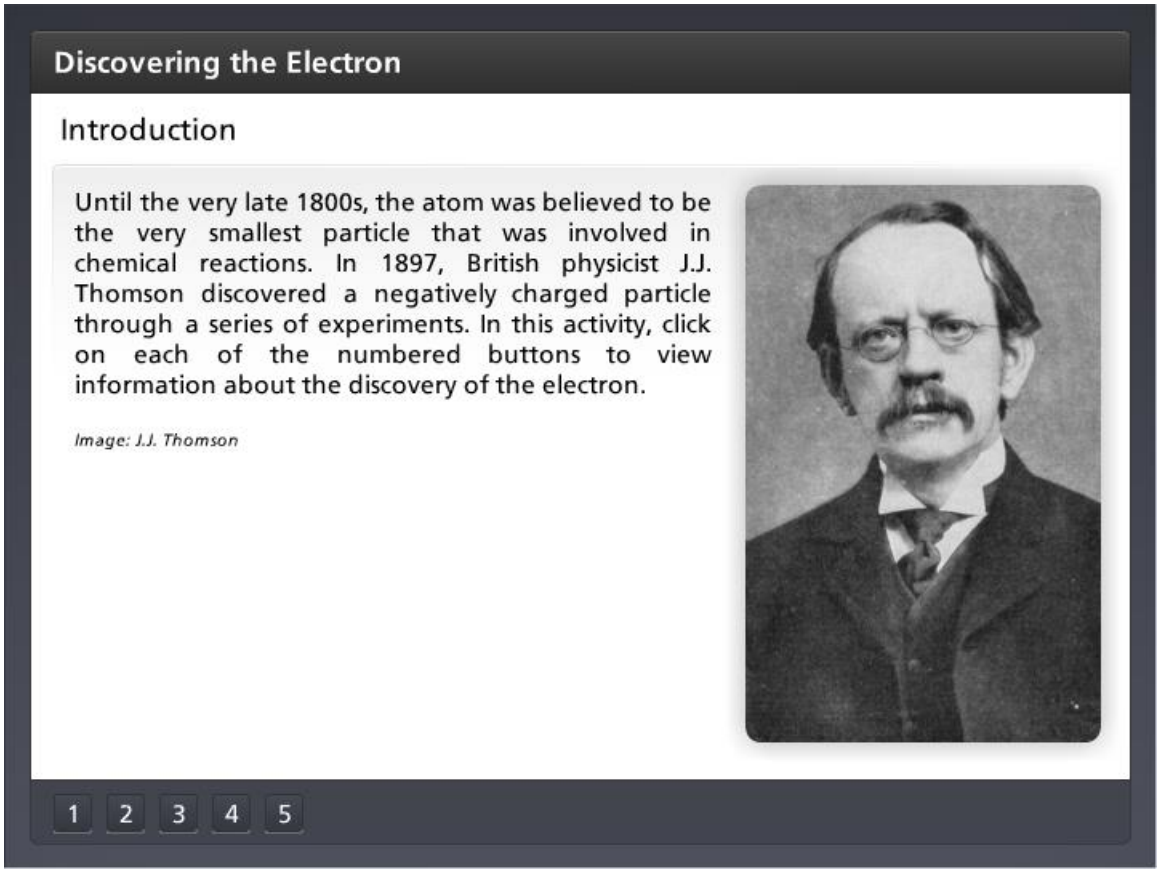
Module 2: Atomic Structure and the History of Atomic Theory
Topic 2 Content: Discovering the Electron Presentation Notes

Introduction



Until the very late 1800s, the atom was believed to be the very smallest particle that was involved in chemical reactions. In 1897, British physicist J.J. Thomson discovered a negatively charged particle through a series of experiments. In this activity, click on each of the numbered buttons to view information about the discovery of the electron.

Image: J.J. Thomson

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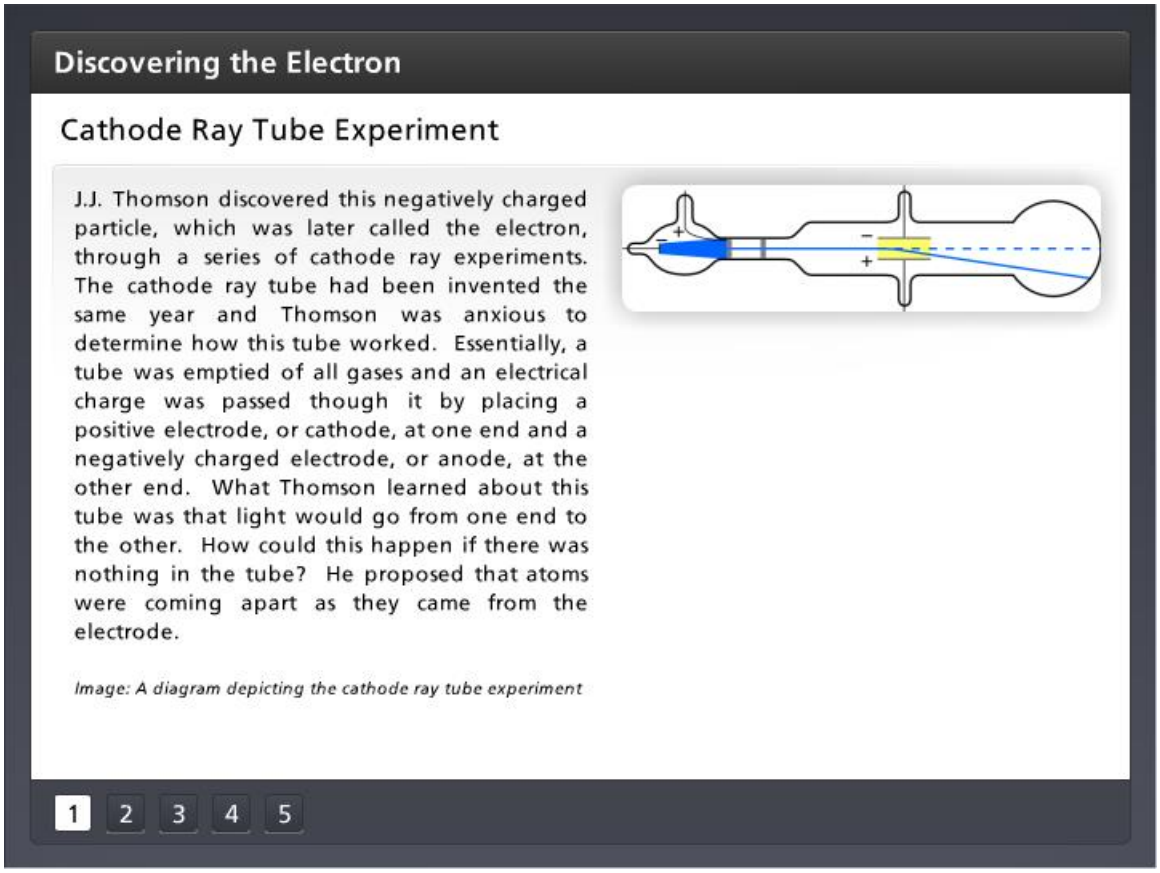
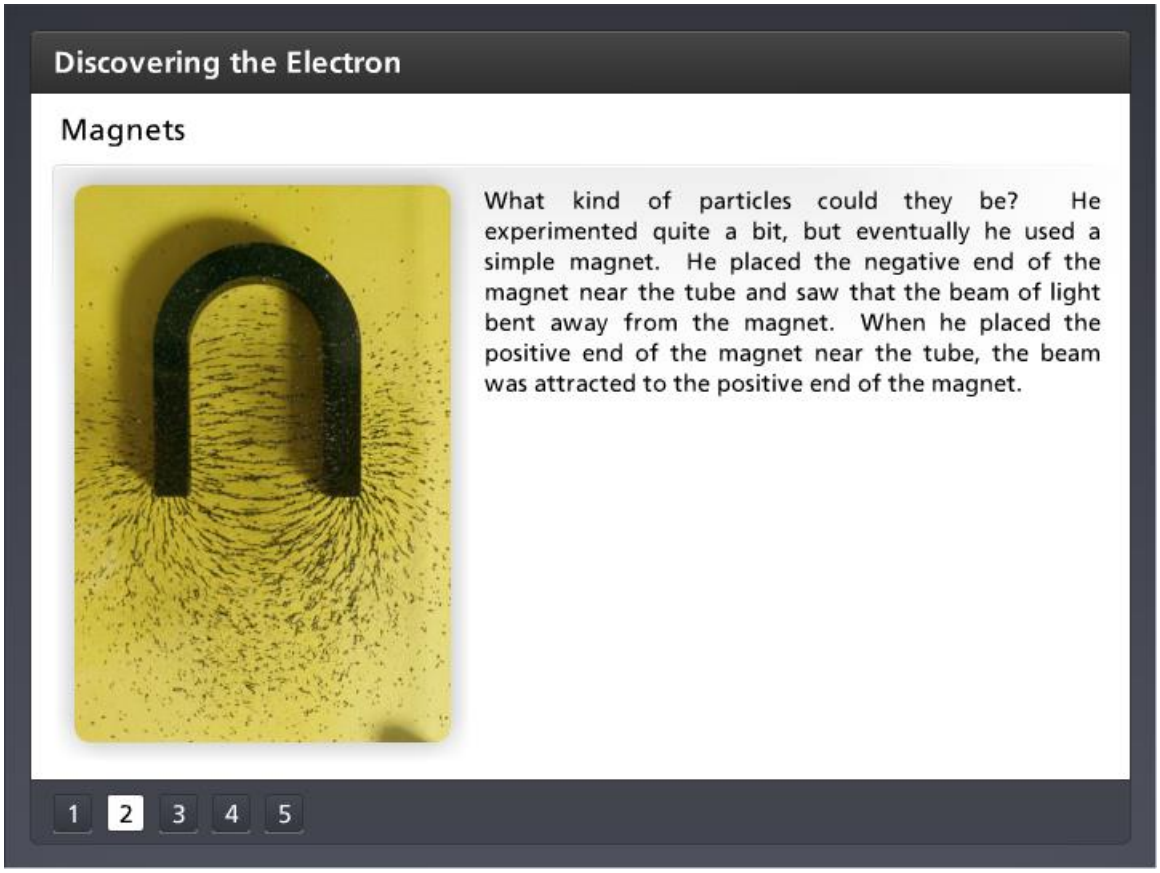
Cathode Ray Tube Experiment



J.J. Thomson discovered this negatively charged particle, which was later called the electron, through a series of cathode ray experiments. The cathode ray tube had been invented the same year and Thomson was anxious to determine how this tube worked. Essentially, a tube was emptied of all gases and an electrical charge was passed though it by placing a positive electrode, or cathode, at one end and a negatively charged electrode, or anode, at the other end. What Thomson learned about this tube was that light would go from one end to the other. How could this happen if there was nothing in the tube? He proposed that atoms were coming apart as they came from the electrode.

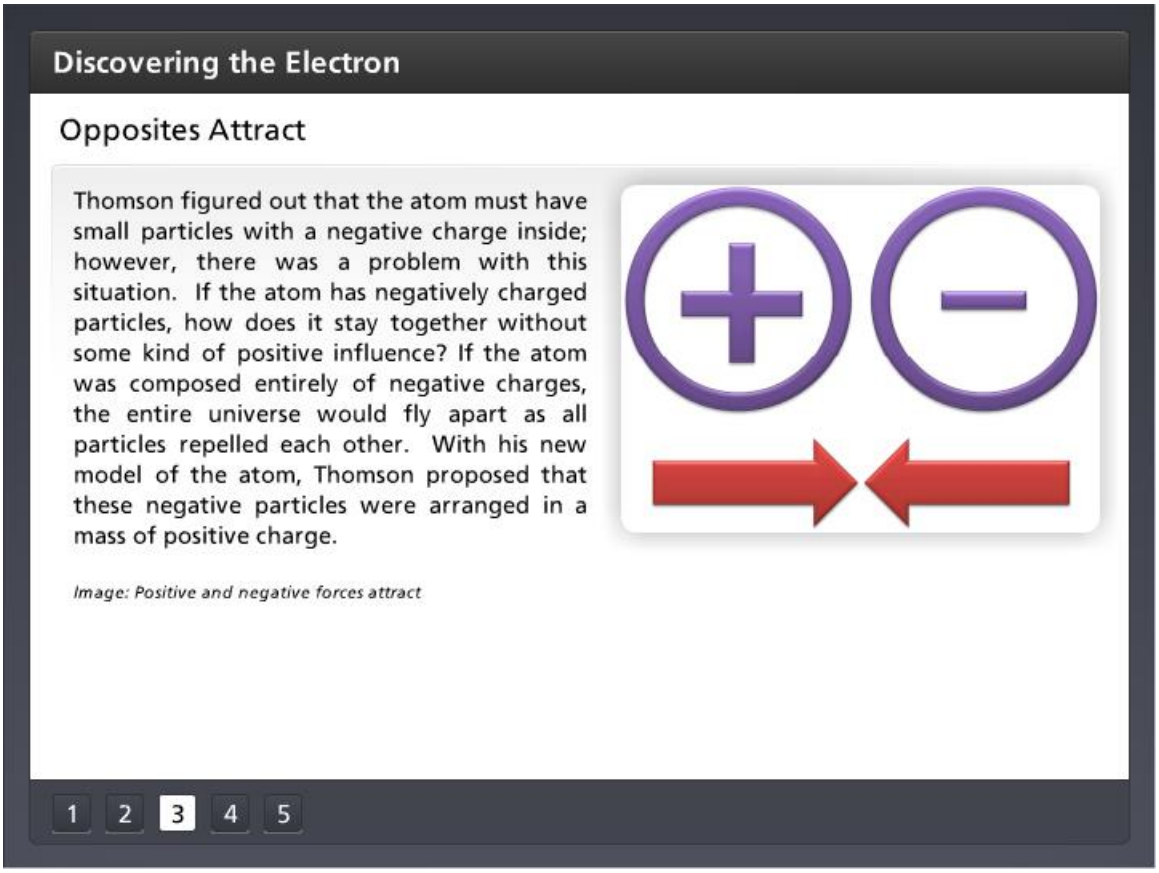
Image: A diagram depicting the cathode ray tube experiment

Magnets



What kind of particles could they be? He experimented quite a bit, but eventually he used a simple magnet. He placed the negative end of the magnet near the tube and saw that the beam of light bent away from the magnet. When he placed the positive end of the magnet near the tube, the beam was attracted to the positive end of the magnet.

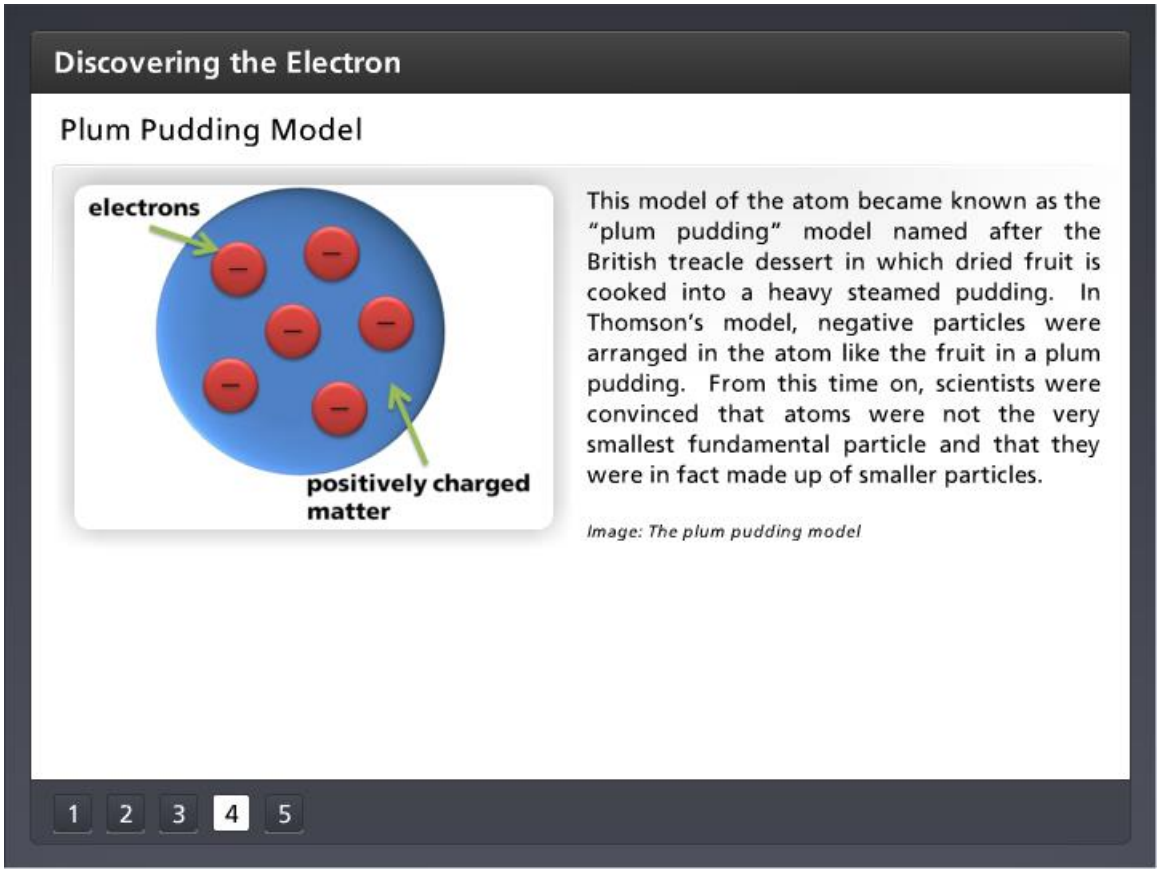
Opposites Attract



Thomson figured out that the atom must have small particles with a negative charge inside; however, there was a problem with this situation. If the atom has negatively charged particles, how does it stay together without some kind of positive influence? If the atom was composed entirely of negative charges, the entire universe would fly apart as all particles repelled each other. With his new model of the atom, Thomson proposed that these negative particles were arranged in a mass of positive charge.

Image: Positive and negative forces attract

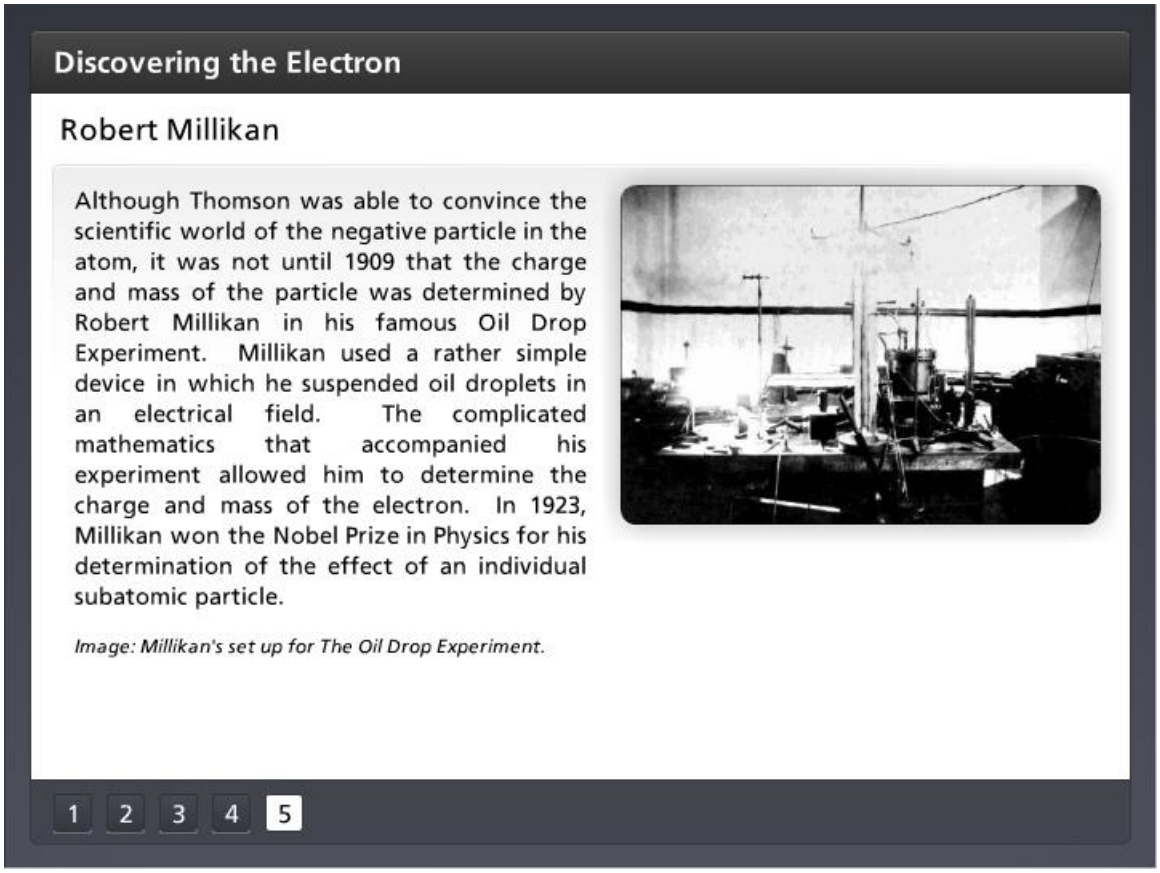
Plum Pudding Model



This model of the atom became known as the "plum pudding" model named after the British treacle dessert in which dried fruit is cooked into a heavy steamed pudding. In Thomson's model, negative particles were arranged in the atom like the fruit in a plum pudding. From this time on, scientists were convinced that atoms were not the very smallest fundamental particle and that they were in fact made up of smaller particles.

Image: The plum pudding model

Robert Millikan



Although Thomson was able to convince the scientific world of the negative particle in the atom, it was not until 1909 that the charge and mass of the particle was determined by Robert Millikan in his famous Oil Drop Experiment. Millikan used a rather simple device in which he suspended oil droplets in an electrical field. The complicated mathematics that accompanied his experiment allowed him to determine the charge and mass of the electron. In 1923, Millikan won the Nobel Prize in Physics for his determination of the effect of an individual subatomic particle.

Image: Millikan's set up for The Oil Drop Experiment.