HARRY MOSELEY: NUMBERING THE ELEMENTS

Chapter 1 – The Discovery of the Electron (1:38)
In 1897, Cambridge University physicist J.J. Thomson discovers that electricity is many up of tiny, negatively charged particles. Electrons, Thomson argues, are not just the unit of electricity but a piece of every atom. With this discovery, the race is on to identify the rest of the atom's pieces and understand how they fit together.

Chapter 2 – Harry Moseley (1:44)
One of those soon caught in this race is Harry Moseley, a physicist from a prominent family of British scientists. After graduating from Trinity College Oxford, Moseley decides to pursue graduate studies 200 miles to the north, drawn to Manchester by the brightest star in physics: a New Zealander named Ernest Rutherford.

Chapter 3 – Rutherford's Boys (1:47)
Rutherford has already won the Nobel Prize for his research on radioactivity. In Manchester, he puts together one of the finest groups of young scientists ever assembled in one place. Under Rutherford's watchful eye, they explore radioactivity and the structure of the atom, with new discoveries practically every week.

Chapter 4 – The Discovery of the Nucleus (2:34)
Two of Rutherford's graduate students have been bombarding thin gold foil with radioactive particles. From their surprising results, Rutherford draws a radical new picture of the atom: All of its positive charge and most of its mass are concentrated in a tiny central core he calls the nucleus, with the electrons in orbit around it.

Chapter 5 – X-Ray Diffraction (3:01)
Bored with his radioactivity research, Moseley strikes out in a new direction, following up on a German discovery that X-rays can be "diffracted" in much the way light can be broken into a spectrum of colors with different frequencies. Moseley and Charles G. Darwin persuade Rutherford to let them focus on this new topic.

Chapter 6 – The Hardest Worker (1:56)
The two collaborators spend six months exploring X-rays, with Moseley often working through the night. When Darwin leaves the partnership to return to Rutherford's work on the atom, Moseley decides to use X-rays as a tool to investigate the nature of the elements. This is where his brilliant discoveries begin.

Chapter 7– X-Ray Spectroscopy (3:31)
To speed up his work, Moseley designs a long X-ray tube that allows him to test one element after another. He discovers that each element has a unique X-ray spectrum – a "barcode" like the ones that had been discovered with the invention of the light spectroscope in 1859. He's discovered a whole new branch of spectroscopy.

Chapter 8 – Moseley's Staircase (1:47)
To Moseley's surprise, when he lays out the spectra of consecutive elements, they rise in frequency, step by step, forming a striking pattern that comes to be known as "Moseley's staircase." The pattern reveals an amazingly simple relationship between an element's X-ray spectrum and its atomic number.

Chapter 9 – Atomic Number (the Proton) (2:03)
Moseley's work shows that atomic number is not just the number of an element's box in the Periodic Table. It represents the amount of positive charge on the element's nucleus. Building on this work, Rutherford soon discovers the positive particle known responsible for this charge – the proton – and shows that each element is defined by the number of protons in its nucleus: its atomic number.

Chapter 10 – Calling the Roll of the Elements (1:27)
Armed with his X-ray machine, Moseley can quickly tell real elements from imagined ones, simply by measuring their atomic numbers. Even more remarkable, he can "call the roll of the elements," showing how many elements remain to be discovered and where they will fit in the Periodic Table.

Chapter 11 – Moseley's Death (3:03)
When England is drawn into the war in Europe in 1914, Moseley interrupts his research to serve at the front. In August 1915, the 27-year-old communications officer is shot in the head and killed, prompting one fellow physicist to say that Moseley's death alone makes World War I "one of the most hideous crimes in history."