3 - Atomic Structure

The Heart of Matter: Exploring the Atomic Core

Video 3 - Transcript

Hi everyone, welcome to video number 3. Today we're going to be exploring the atomic structure. In the last video, we met many atoms in the periodic table. Today, we're going to be going a little deeper into the sub-atomic particles, which make up atoms. There are three main sub-atomic particles that we need to be aware of. Protons, neutrons, and electrons. We have a table here that gives us some basic information about the properties of these sub-atomic particles. Protons have a relative mass of one, neutrons also have a relative mass of one. Electrons are considered to have no mass, relative mass of zero. It's actually extremely small, but for our purposes, we can consider it to be negligible. The charge of a proton - +1; the charge of a neutron - there's no charge on a neutron, and the charge on an electron is negative (-1). The location of the proton is within the nucleus of the atom. The location of the neutron is also within the nucleus. The location of the electrons, well, these exist in shells or orbitals around the nucleus. In the periodic table, you would have seen some numbers written to the top and bottom left of the symbols of the atoms. For example, carbon. Carbon has the number 12 written at the top left and the number 6 written at the bottom left. What do these numbers stand for? Well, 12 refers to the Mass Number of this atom, 6 refers to the Atomic Number of this atom. What do these numbers mean? The mass number is equal to the number of protons plus the number of neutrons. The mass number, because if we remember protons and neutrons exist in the nucleus. The mass number therefore gives us the mass of the nucleus of the atom. The atomic number gives us the number of protons. We can look at another example. To exemplify mass number and atomic number, we can use phosphorus. Phosphorus has a mass number of 31, atomic number of 15. If we take the mass number minus the atomic number, 31 -15 we get 16. 16 is the number of neutrons, 16 is the number of neutrons in the nucleus of a phosphorus atom. We can represent atoms like this. We have the nucleus, we have our first shell, and we have our second shell. Now I'm going to draw oxygen. Oxygen has an atomic number of eight. We have two electrons in the first shell, we have six electrons in the second shell. Now the nucleus contains the positive protons and the neutral neutrons. Therefore, the nucleus is positively charged. The electrons are negatively charged. The electrostatic force of attraction between the positive nucleus and the negative electrons holds the atoms together. Now, the closer an electron is to the nucleus, the stronger the force of attraction. Therefore, the more stable it is, the further away from the nucleus, the less is the attraction. Therefore, the less stable it is. Electrons that are located in the outermost shells participate in bonding with other atoms. These are called valence electrons. Valence electrons exist in the outermost shell. Based on this diagram we've drawn here, Oxygen has six valence

electrons. You might be wondering, why did we put two electrons in the first shell, and then we put six in the second shell. That's a great question. We're going to look at why we've done this in the next video when we look at electronic configuration. I'd like to wrap up this video by talking a little bit about isotopes. The definition of an isotope is that it is the member of a family of an element that has the same number of protons but different numbers of neutrons. That means that isotopes have the same atomic number but different mass numbers. For example, I can have carbon 12, carbon 13, and carbon 14. We are all accustomed with carbon 12 because basically we have carbon 12 having six protons and six neutrons. Carbon 13 has six protons and seven neutrons. Carbon 14 has six protons and eight neutrons. These are all isotopes of carbon. Now, that does not mean that they belong to a different element. They're all still carbon. The element is determined by the atomic number, and the atomic number here is the same. However, isotopes of elements have different properties. For example, carbon 14 is radioactive and is used to, for example, determine the age of fossils in a process known as carbon dating. That's about all we're going to talk about today, regarding the atomic structure. I hope that this has clarified for us protons, neutrons, and electrons. And I'll see you guys in the next video where we're going to look at electronic configuration.