Podcast Script – Periodic Table and Electron Configurations.

Hello,

This podcast comes to you today from Dhahran, Saudi Arabia, sponsored by Scramling Science. Today’s topic is Periodic Table and Electron Configurations.

Before we start the podcast, it would be helpful to have a Periodic Table handy for reference. Pause the podcast if needed, and find a Periodic Table. The beauty of the Periodic Chart is in its organization. Elements in a column (known as group) have chemical properties that are similar to each other. We have learned previously that chemical properties are based on an element’s electron configuration. Therefore we can conclude that there is a pattern between the order of the elements on the Periodic Table and their electron configuration – and we would be correct.

Since the beginnings of the Periodic Table occurred before electron configuration were determined, we can also look at the existing pattern of the elements on the chart and see if there are any relationships to be found.

The results are remarkable. We can start by checking out the Group 1 elements, located in the first column to the far left of the chart.

Let’s recall that an element’s properties are based on the outer shell electron configuration.

Hydrogen has an electron configuration of 1s1 Lithium’s outer shell is 2s1 Sodium is 3s1 Potassium is 4s1 Rubidium is 5s1 and Cesium is 6s1.

The only thing that changes is the energy level that the lone outer shell electron is located in. These elements are similar chemically and their organization on the Periodic Table couldn’t be any better. Now let’s go to Beryllium. The outer shell configuration is 2s2  Going down the column gives us Mg with an outer shell of 3s2 Calcium with 4s2 Strontium is 5s2 Barium is 6s2 and finally Radium is 7s2

Once again, we see incredible organization. It should start getting clear that the periodic chart can be an incredible help in our understanding of chemistry, as well as saving us a lot of time.

Let’s look at the two sets of elements we have done so far. There are 2 electrons in an s orbital. It is not just coincidence that the first group we took (the group to the far left of the chart) had an s1 configuration and the second group to the left had an s2 configuration. The organization of the chart put these similar elements together and the first two columns together can also be called the s-block elements.

In a similar fashion, we can go to the other side of the Periodic Table and start with the Noble Gases, which are to the far right. Helium has a filled outer shell of 1s2. Neon has a filled outer shell of 2s22p6 Argon has 3s23p6Krypton has 4s24p6 Xenon has 5s25p6 and finally Radon has 6s26p6 Just to avoid any confusion, let’s take a quick look at Helium to make sure there is no misunderstanding. The others have a filled set of p-orbitals, but not Helium. The reason for this is that we don’t find p-orbitals in the first energy level because the first energy level isn’t big enough to hold p-orbitals. The important pattern for the Noble Gases is that they all have a filled outer shell, which makes them naturally stable. This is why they don’t naturally react with anything.

Moving over one column to the halogens, we find the following outer shell configuration: Fluorine with 2s22p5 Chlorine with 3s23p5 Bromine with 4s24p5 Iodine has 5s25p5 and Astatine with 6s26p5

The Oxygen Group all has an outer shell electron configuration of s2p4

The Nitrogen Group has an outer shell configuration of s2p3

The Carbon Group’s electron configuration is s2p2 and the Boron’s group is s2p1

We can even get more information from knowing how the chart works if we study the information given above.

Let’s go back to the s-block of elements. This would be a great time to pause the podcast and get a copy of a periodic chart if you don’t have one in front of you.

Look at Li and Be. Their electron configuration is 2s1 and 2s2 respectively. Look at Na and Mg. Their electron configuration is 3s1 and 3s2 respectively. We can use the period to tell us which energy level the element will have its outer shell in. The s-orbital starts with the first energy level so we simply count down. Let’s use Barium as an example. Hydrogen is 1, Lithium is 2, Sodium is 3, Potassium is 4, Rubidium is 5 and Cesium is 6. So we know that that set of s-block elements is going to be 6s – something. Well, Cesium is the first element so that is going to be 6s1 and Barium is the second so that is going to be 6s2.

The same thing can be used for the p-block. Let’s use Lead as an example. The p – orbitals start at the second energy level. The Boron to Neon row all have their outer electrons in the 2p set of orbitals, The next row; Aluminum to Argon are in the 3p set, Gallium to Krypton are in the 4th set, Indium to Xenon are in the 5th set, and Thallium to Radon are in the 6th set. Lead is the second one over so the outer shell electron configuration for Lead is 6s26p2 -- Don’t forget the s-orbital electrons !

We will wrap up this discussion by looking at a few of the d-block elements, which are located where the transition elements are found.

We will use Iridium as an example. The d-block orbitals are found starting with the 3rd energy levels. So Scandium to Zinc all end in the 3d – something orbitals. Yttrium to Cadmium all end in the 4d – something orbitals, Lanthanum to Mercury all end in the 5d – something orbitals. We count over and see that Iridium is the 7th element and so the configuration is 5d7 We can see a similar trend in the inner-transition elements found at the bottom of the Periodic Table.

It is important to note that this works perfectly for the s-block and the p-block elements, but that there are several exceptions when dealing with the d-block and f-block elements. You are not responsible for these exceptions, unless specifically told by your teacher.

I hope you enjoyed today’s Podcast and found it entertaining and educational, and helped you with your understanding of Periodic Table and Electron Configurations. Remember that you can get more information on this topic from the class website or you can always send me a note on either FaceBook or via email. Refer back to this topic when needed, courtesy of Scramling Science.