The periodic table of elements

The Periodic Table of Elements is used as a way of displaying all the known chemical elements; it is accepted and used all over the world. The periodic table’s layout is very well structured; it consists of vertical rows called groups and horizontal rows called periods. It is one of the most important resources in chemistry and the key to discovering new elements. The beauty of the Periodic Table is that a lot of information about any element can be gathered just by looking at its position within the table.

Effectively understanding the table is essential for chemistry. The physical and chemical properties of elements can also be predicted; even the prediction of how a certain element will react with another can be made with good accuracy, using the periodic table. This is all because of its trends and amazing structure. In the Periodic Table, a group is a vertical row going from top to bottom. Groups contain elements that have similar outer shell electron configurations. This means that if you look down a group of elements, e. g. Group 2 and write each of the elements electronic configurations, they will all end in S2.

Each group is numbered according to the outer shell electron configuration of the atoms, of that particular group of elements. Usually groups of elements are numbered in Roman numerals, going from I-VIII. A period is a horizontal row going from left to right across the table. Each period is labelled from 1-7 and contains elements that have electrons which are in the same outer shell. The number of an elements outer shell will be equal to the number of the period it’s in.

Positioning of Elements in the Periodic Table Elements have been strategically placed around the periodic table to have something in common with the elements around them… Atomic radius or width of an atom is half of the length between two nuclei of a diatomic molecule. The atomic radius increases as you move down a group of the periodic table because each element going down has an extra main layer of electrons, therefore expanding the radius. Atomic radius decreases going across a eriod because of the increase in valence or outer electrons.

This makes the electrostatic force at a higher level meaning the attraction is stronger for valance layers and they are drawn in closer together therefore making the atomic radius smaller. Melting points for metals usually decrease as you go down a group and the melting point for non metals usually increases going down a group. This is because when substances melt the attractive forces keeping their particles together are either broken or loosened enough for them to move freely.

The stronger the forces are holding the particles together the more energy is needed to break the attractive forces, therefore making it have a much higher melting point. An example of this is silicon because its atoms are held so strongly together by covalent bonds that it makes its melting point extremely high. Boiling point decreases going down a group and is quite similar to melting points because the boiling breaks or loosens the attractive forces at certain temperatures. Substances which are held together by stronger covalent bonds require a much higher temperature for their boiling point.

Electrical conductivity is the ability that an element has to conduct electricity. Metals are good conductors because of their free moving electrons. Ionisation energy relates to electronegativity and is the amount of energy that is required to take the outmost electron from an atom. Ionization energy decreases going down a group because the atoms are getting bigger and their hold on their electrons is a lot weaker as they are further out. Ionization energy increases going across a period because the atoms are getting smaller because their high levels of electronegativity.

Combining Power or (valency) is the number of chemical bonds; an element has, made by its atoms. Reactivity and Electronegativity Reactivity is the speed of response that a chemical substance has to certain stimulation. In chemistry, this would be how long it takes to have a chemical reaction with another substance. Reactivity decreases going left to right across a period and increases going down a group.

This is because as we move down a group atoms increase in size and there is a weaker force llowing the electrons to be taken much easier making it reactive. Electronegativity is the measure of attraction that an elements atoms have for electrons. The stronger the attraction for electrons, the atom has, the higher its electronegativity will be. The type of bond that one atom will form with another can be, either ionic or covalent; and this can be determined by the different electronegativities, the two atoms have. Electronegativity increases going left to right across a period and decreases going down a group.

History of the Periodic Table: Many chemists during the 19th century started categorizing elements according to the similarities of their properties, both physical and chemical. Further studies, modifications and refinements of the Periodic Table; as well as the discovery of new elements; has resulted in our modern Periodic Table. Dmitri Mendeleev is considered the inventor or Father of the Periodic Table but one of the first people known to tackle the challenge of trying to organise all of the known elements at the time, was Johann Dobereiner.

He started in 1817 and in 1829 he managed to develop a way of classifying some of the elements into groups of three. He called these groups triads. The elements which were placed into a triad had similar chemical properties and neatly arranged physical properties; these groups became known as Dobereiner’s triads. Then in 1863 John Newlands devised a way of organising the elements into octaves, creating and publishing the first periodic table which was arranged in order of atomic weight.

Newland was ridiculed at the time until finally, five years later, Dmitri Mendeleev; a Russian chemist published a more advanced periodic table, independently, which organized elements by increasing atomic mass in 1869. It was this table that was the fundamentals for our modern Periodic Table today, which is now arranged by atomic number. There were many gaps in Mendeleev’s table when it was first published. These gaps were for undiscovered elements such as Re, Fr and all of the noble gases etc.

The reason Mendeleev’s method for the table was accepted and he is known as the father of the periodic table was because he was so confident in

himself, that he was able to predict the properties of 3 undiscovered elements. The undiscovered elements now known as Sc, Ga and Ge, had very close properties to what Mendeleev had predicted using his table, therefore his periodic table became widely accepted. Mendeleev was able to accurately predict the existence and physical properties of unknown elements by looking at many of the trends within his table.

He focussed mainly on the properties of other elements and placed titanium in a row with silicon and carbon, leaving a gap next to aluminium and boron. This gap he predicted was an unknown element, whose atomic mass would be in between 40 and 48. In 1878 an element called scandium was discovered, its properties were, as predicted by Mendeleev and its atomic mass was around 45. He could also predict, to a certain extent, how these undiscovered elements would react with other elements.