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# Introduction & Characteristics of the Modern Periodic Table

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**Abstract: In this paper, we describe the effort of defining and compiling existing visualization methods in order to develop a systematic overview based on the logic, look, and use of the periodic table of elements. We first describe the current fragmented state of the visualization field. Then we outline the rules and criteria we applied in conducting our research in order to present a revised periodic table of 100 visualization methods with a proposition how to use it. In the long form of periodic table only 118 elements can exist. That time it was also consider that the number of elements would be finite when it is impossible because when time the universe and human body exist new elements will be discovered. The properties of blocks periods are same as long form of periodic table. There hydrogen exists at only one place but show the position with noble gases as well as metal elements also. The position of lanthanide and actinide series is not showing separate. There exist five block and nine periods if in future any new block and any group will be required they will be exist as define in upper periods as h1, h2 etc.**

**Keywords: Periodic Table, Metals, Elements, Alkaline, Compounds, Groups, Periods etc.**

## I. INTRODUCTION

The intermittent table is a forbidden course of action of the compound components, requested by their nuclear number, electron designs, and repeating concoction properties. This requesting indicates intermittent patterns, for example, components with comparative conduct in a similar section. It likewise indicates four rectangular squares with some around comparable substance properties. When all is said in done, inside one line (period) the components are metals on the left, and non-metals on the right. The lines of the table are called periods; the sections are called gatherings. Six gatherings have for the most part acknowledged names and also numbers: for instance, amass 17 components are the incandescent lamp; and gathering 18, the honorable gasses. The intermittent table can be utilized to infer connections between the properties of the components, and foresee the properties of new components yet to be found or orchestrated. The intermittent table gives a valuable structure to examining substance conduct, and is generally utilized as a part of science and different sciences.

The Russian scientific expert Dmitri Mendeleev distributed the primary generally perceived intermittent table in 1869. He built up his table to represent occasional patterns in the properties of the then-known components. Mendeleev additionally anticipated a few properties of then-obscure components that would be relied upon to fill holes in this table. A large portion of his forecasts were demonstrated right when the components being referred to were accordingly found. Mendeleev's occasional table has since been extended and refined with the revelation or combination of further new components and the improvement of new hypothetical models to clarify substance conduct. All components from nuclear numbers 1 (hydrogen) to 118 (oganesson) have been found or combined, with the latest increments (nihonium, moscovium, tennessine, and oganesson) being affirmed by the International Union of Pure and Applied Chemistry (IUPAC) in 2015 and authoritatively named in 2016: they finish the initial seven lines of the intermittent table. The initial 94 components exist normally, albeit some are discovered just in follow sums and were orchestrated in labs before being found in nature. Components with nuclear numbers from 95 to 118 have just been blended in labs or atomic reactors. Combination of components having higher nuclear numbers is being sought after. Various manufactured radio nuclides of normally happening components have additionally been created in research centers.

**To begin with systemization endeavors**

The disclosure of the components mapped to critical intermittent table improvement dates (pre-, per-and post-)In 1789, Antoine Lavoisier distributed a rundown of 33 substance components, gathering them into gasses, metals, nonmetals, and earths. Scientific experts spent the next century looking for a more exact characterization plot. In 1829, Johann Wolfgang

Döbereiner watched that huge numbers of the components could be assembled into sets of three in view of their concoction properties. Lithium, sodium, and potassium, for instance, were assembled together in a set of three as delicate, receptive metals. Döbereiner additionally watched that, when orchestrated by nuclear weight, the second individual from every set of three was generally the normal of the first and the third; this ended up plainly known as the Law of Triads.German scientific expert Leopold Gmelin worked with this framework, and by 1843 he had recognized ten sets of three, three gatherings of four, and one gathering of five. Jean-Baptiste Dumas distributed work in 1857 portraying connections between different gatherings of metals. Albeit different scientists could recognize connections between little gatherings of components, they still couldn't seem to manufacture one plan that included them all. In 1857, German scientific expert August Kekulé watched that carbon frequently has four different particles clung to it. Methane, for instance, has one carbon iota and four hydrogen molecules. This idea in the end wound up plainly known as valency; distinctive components bond with various quantities of iotas.

The criticalness of nuclear numbers to the association of the occasional table was not acknowledged until the point when the presence and properties of protons and neutrons wound up plainly caught on. Mendeleev's occasional tables utilized nuclear weight rather than nuclear number to sort out the components, data definite to reasonable accuracy in his chance. Nuclear weight functioned admirably enough as a rule to (as noted) give an introduction that could anticipate the properties of missing components more precisely than some other technique at that point known. In 1862, Alexandre-Emile Béguyer de Chancourtois, a French geologist, distributed an early type of intermittent table, which he called the earthly helix or screw. He was the primary individual to see the periodicity of the components. With the components organized in a winding on a barrel by request of expanding nuclear weight, de Chancourtois demonstrated that components with comparable properties appeared to happen at customary interims. His graph incorporated a few particles and mixes notwithstanding components. His paper additionally utilized land as opposed to concoction terms and did exclude a graph; subsequently, it got little consideration until crafted by Dmitri Mendeleev. In 1864, Julius Lothar Meyer, a German physicist, distributed a table with 44 components orchestrated by valency. The table demonstrated that components with comparative properties frequently had a similar valency. Simultaneously, William Odling (an English physicist) distributed a plan of 57 components, requested on the premise of their nuclear weights. With a few anomalies and holes, he saw what seemed, by all accounts, to be a periodicity of nuclear weights among the components and this concurred with "their typically got groupings" Odling suggested the possibility of an intermittent law yet did not seek after it He accordingly proposed (in 1870) a valence-based arrangement of the components.

| | No. | | No. | | No. | | No. | | No. | | No. | | No. | | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H | 1 | F | 8 | Cl | 15 | Co & Ni | 22 | Br | 29 | Pd | 36 | I | 42 | Pt & Ir | 50 |
| Li | 2 | Na | 9 | K | 16 | Cu | 23 | Rb | 30 | Ag | 37 | Cs | 44 | Os | 51 |
| G | 3 | Mg | 10 | Ca | 17 | Zn | 24 | Sr | 31 | Cd | 38 | Ba & V | 45 | Hg | 52 |
| Bo | 4 | Al | 11 | Cr | 19 | Y | 25 | Ce & La | 33 | U | 40 | Ta | 46 | Tl | 53 |
| C | 5 | Si | 12 | Ti | 18 | In | 26 | Zr | 32 | Sn | 39 | W | 47 | Pb | 54 |
| N | 6 | P | 13 | Mn | 20 | As | 27 | Di & Mo | 34 | Sb | 41 | Nb | 48 | Bi | 55 |
| O | 7 | S | 14 | Fe | 21 | Se | 28 | Ro & Ru | 35 | Te | 43 | Au | 49 | Th | 56 |

**Fig. 1: periodic table, as presented to the Chemical Society in 1866**

English chemist John Newlands produced a series of papers from 1863 to 1866 noting that when the elements were listed in order of increasing atomic weight, similar physical and chemical properties recurred at intervals of eight; he likened such periodicity to the octaves of music. This so termed Law of Octaves, however, was ridiculed by Newlands' contemporaries, and the Chemical Society refused to publish his work. Newlands was nonetheless able to draft a table of the elements and used it to predict the existence of missing elements, such as germanium. The Chemical Society only acknowledged the significance of his discoveries five years after they credited Mendeleev. In 1867, Gustavus Hinrichs, a Danish born academic chemist based in America, published a spiral periodic system based on atomic spectra and weights, and chemical similarities. His work was regarded as idiosyncratic, ostentatious and labyrinthine and this may have militated against its recognition and acceptance.

The relativistic Dirac equation has problems for elements with more than 137 protons. For such elements, the wave function of the Dirac ground state is oscillatory rather than bound, and there is no gap between the positive and negative energy spectra, as in the Klein paradox. More accurate calculations taking into account the effects of the finite size of the nucleus indicate that the binding energy first exceeds the limit for elements with more than 173 protons. For heavier elements, if the innermost orbital (1s) is not filled, the electric field of the nucleus will pull an electron out of the vacuum, resulting in the spontaneous emission of a positron; however, this does not happen if the innermost orbital is filled, so that element 173 is not necessarily the end of the periodic table.

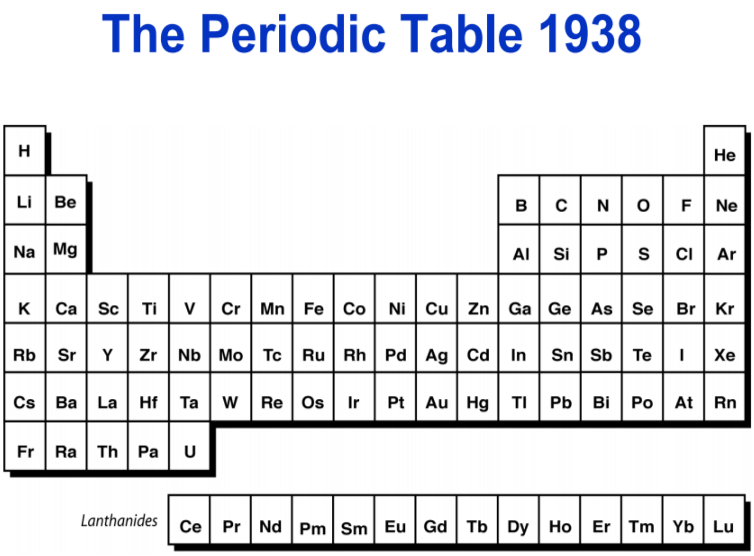


**Fig. 2: Periodic Table in 1938** **Fig.3: Dmitri Ivanovich Mendeleev**

**Periods**

Each of the table's horizontal rows is called a period. Along a period, a gradual change in chemical properties occurs from one element to another. For example, metallic properties decrease and nonmetallic properties increase as you go from left to right across a period. Changes in the properties occur because the number of protons and electrons increases from left to right across a period or row. The increase in number of electrons is important because the outer electrons determine the element's chemical properties. The periodic table consists of seven periods. The periods vary in length. The first period is very short and contains only 2 elements, hydrogen and helium. The next two periods contain eight elements each. Periods four and five each have 18 elements. The sixth period has 32 elements. The last period is not complete yet because new exotic or manmade elements are still being made in laboratories.

**METALS**

As you can see, the vast majority of the known elements are metals. Many metals are easily recognized by non-chemists. Common examples are copper, lead, silver and gold. In general, metals have a luster, are quite dense, and are good conductors of heat and electricity. They tend to be soft, malleable and ductile (meaning that they are easily shaped and can be drawn into fine wires without breaking). All of these properties are directly related to the fact that solid metals are crystals formed from positive ions surrounded by mobile electrons. This mobility allows electrons to absorb and reflect light in many wavelengths, giving the metals their typical luster. It also permits electrons to absorb thermal and electrical energy from the environment or neighboring electrons and transfer this energy to other electrons; in this way, heat and electricity can be conducted throughout the metal. These mobile electrons hold the positive metallic ions so tightly that even when the metal sample is only a few layers thick, as in gold foil, the sample stays intact. So, the density, malleability, and ductility of metals are also due to electron mobility. The difference in the coloring on the periodic table indicates that the most metallic elements are those on the left side of the table. The Group I Alkali Metals and the Group II Alkaline Earths have more metallic characteristics than elements farther right whose square are colored blue, especially those that border on the metalloid elements. Generally speaking, the most metallic metals are in the bottom left corner. As you move toward the upper right on the periodic table, elements become less metallic in property.

**Alkali Metals**

The alkali (IA) metals show a closer relationship in their properties than do any other family of elements in the periodic table. Alkali metals are so chemically reactive that they are never found in the element form in nature. All these metals react spontaneously with gases in the air, so they must be kept immersed in oil in the storeroom. They are so soft that they can be cut with an ordinary table knife, revealing a very "buttery", silvery metal surface that immediately turns dull as it reacts with water vapor and oxygen in the air. The chemical reactivity of alkali metals increases as the atomic number increases. Their reactions with halogens, elements in Group VIIA, are especially spectacular because some of them emit both light and heat energy. They react with other nonmetals, albeit more slowly, forming compounds that are very stable. They also react with acids, forming hydrogen gas and salts; with water they form hydrogen gas and metallic hydroxides, which are sometimes called bases. They react with hydrogen to form metallic hydrides, which form strong bases in water. In all these reactions, the metals form ionic compounds, in which each metal atom loses one electron to form a positively-charged ion or cation. All compounds of alkali metals are soluble in water. These compounds are widely distributed. Large mineral deposits of relatively pure compounds of sodium and potassium are found in many parts of the world. Sodium and potassium chlorides are among the most abundant compounds in sea water. Potassium compounds are found in all plants and sodium and potassium compounds are essential to animal life—including human life. Lithium (Li) is the alkali metal of most interest to Genesis scientists.

**Alkaline Earth Metals**

The alkaline earth (IIA) metals also exhibit the typical metal characteristics of high density, metallic luster and electrical and thermal conductivity. Rocks and minerals containing silica, magnesium, and calcium compounds are widely distributed. These chemicals are also abundant as compounds in sea water. Their chlorides are abundant in sea water. Radium, the largest of the alkaline earths, is a radioactive element that occurs naturally only in very small quantities. Chlorophyll, the green coloring in plants, is a magnesium-containing compound. Calcium is a major component of animal bones, teeth and nerve cells. Alkaline earth elements form compounds by losing, or in the case of beryllium, sharing two electrons per atom. These atoms hold their electrons more tightly than alkali metals. They are, therefore, smaller than and not so chemically reactive as the neighboring alkali metals. They do not require special storage because the surface of these metals reacts with air, forming a tightly adhering layer that protects the metal and prevents additional reactions. None of them is found naturally as a free element. The chemical reactivity of these elements increases with size. Calcium, strontium, and barium react with water forming hydrogen and alkaline compounds. Magnesium reacts with steam to produce magnesium oxide. Common oxides of alkaline earth metals include lime (CaO) and magnesia (MgO), which react with water to produce strongly alkaline solutions. The alkali metals also react readily with many other types of chemicals, including acids, sulfur, phosphorus, the halogens (Group VIIA), and, with the exception of beryllium, hydrogen. Alkaline earth halides are quite soluble in water. The water solubility of their hydroxides increases, but the solubility of their carbonates and sulfates decrease with increasing atomic number. The presence of calcium and magnesium ions in water make it "hard" because they form insoluble salts with soap. Solid calcium carbonate deposits form on container surfaces when water evaporates. Magnesium (Mg), calcium (Ca), barium (Ba), and beryllium (Be) are all of interest to Genesis researchers.

**METALLOIDS**

The metalloids include boron (B), silicon (Si) and germanium (Ge), arsenic (As) and antimony (Sb), tellurium (Te) and polonium, (Po). Note that they are arranged in stair steps between the metals and nonmetals. Metalloids have some of the properties of metals and nonmetals—and each metalloid has its own unique mixture. A few are shiny like metals, but do not really have a metallic luster. Some metalloids have very high melting and boiling points; others do not. Others conduct electricity, but their electrons are mobile in only certain directions, so they are called semi-conductors. This makes them useful in designing transistors and other solid state electronic components. Genesis scientists are interested in boron because the collection wafer material is pure silicon.

**NONMETALS**

The nonmetallic elements are in the upper right portion of the periodic table. At room temperature and pressure, many of them exist as gases, but one is a liquid. Others are either the hardest or the softest of solids. The nonmetals have few chemical properties in common. They range from fluorine, the most active nonmetal, to the most nonreactive of the elements, the noble gases. Millions of compounds formed from carbon, hydrogen, oxygen, sulfur and nitrogen are known as organic chemicals. Oxides of sulfur and nitrogen have been identified as atmospheric pollutants. Nonmetallic compounds also include salts as well as many acids and bases. Many of these salts are found in soil or dissolved in ocean water. Any ions formed by nonmetals are negatively charged. Almost eighty percent of our atmosphere is made up of nitrogen gas and most of the rest is oxygen, which is necessary for human respiration and metabolism. There are negligible amounts of noble gases in our atmosphere. Many of the nonmetals are colored, including yellow sulfur, red and yellow phosphorus, yellow-green fluorine, pale yellow chlorine, red-brown bromine, and violet-black iodine. Others, like oxygen, nitrogen, and the noble gases are colorless. Only sulfur is found as a free element in nature. Some of the nonmetals are molecular, such as the diatomic halogens, nitrogen, and oxygen; phosphorus forms molecules of four atoms and sulfur is found in rings of eight atoms. The noble gases exist as monoatomic gases. On the other hand, any sample of carbon, whether it be the graphite in your pencil lead or a diamond, is one large molecule of carbon atoms. If metal atoms are closely packed like stacked building materials, leading to high densities, then the low density of nonmetals is like the same building materials widely distributed with open spaces between them in the constructed building. Electrons in the crystalline structures of nonmetallic solids are tightly held in chemical bonds; so, nonmetals are notably good electrical and thermal insulators.

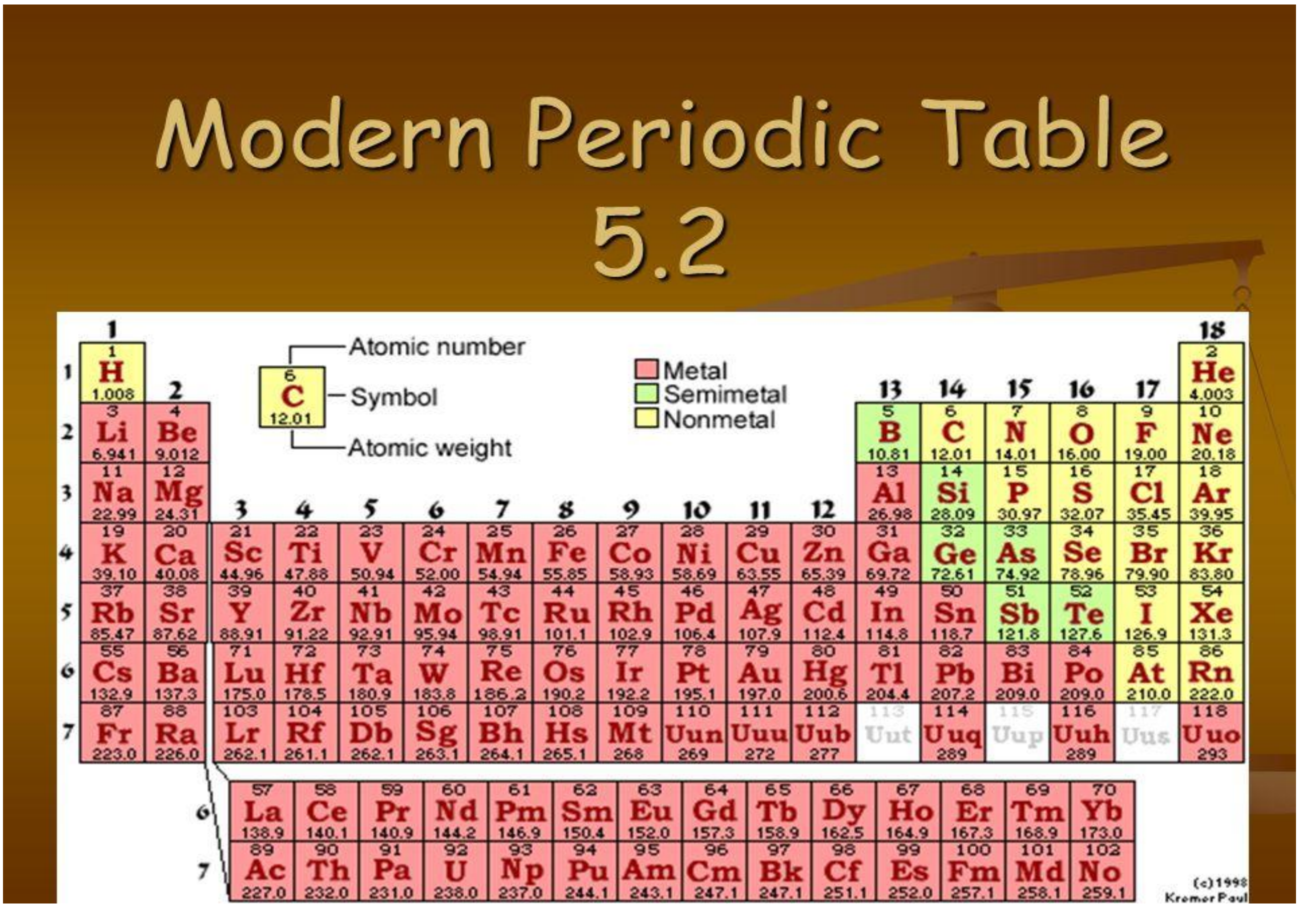


**Fig. 4: Modern Periodic Table**

The elements discovered initially by synthesis and later in nature are technetium (Z=43), promethium (61), astatine (85), neptunium (93), and plutonium (94).

a) An element zero (i.e. a substance composed purely of neutrons), is included in a few alternate presentations, for example, in the Chemical Galaxy.

b) There is an inconsistency and some irregularities in this convention. Thus, helium is shown in the p-block but is actually an s-block element, and (for example) the d-subshell in the d-block is actually filled by the time group 11 is reached, rather than group 12.

c) The noble gases, astatine, francium, and all elements heavier than americium were left out as there is no data for them.

d) While fluorine is the most electronegative of the elements under the Pauling scale, neon is the most electronegative element under other scales, such as the Allen scale.

e) While Lr is thought to have p rather than d electron in its ground-state electron configuration, and would therefore be expected to be volatile metal capable of forming a +1 cation in solution, no evidence of either of these properties has been able to be obtained despite experimental attempts to do so.It was originally expected to have a d electron in its electron configuration and this may still be the case for metallic lawrencium, whereas gas phase atomic lawrencium is very likely thought to have a p electron.An antecedent of Deming's 18-column table may be seen in Adams' 16-column Periodic Table of 1911. Adams omits the rare earths and the "radioactive elements" (i.e. the actinides) from the main body of his table and instead shows them as being "careted in only to save space" (rare earths between Ba and eka-Yt; radioactive elements between eka-Te and eka-I). See: Elliot Q. A. (1911). "A modification of the periodic table". Journal of the American Chemical Society. 33(5): 684–688 (687).

f) A second extra-long periodic table row, to accommodate known and undiscovered elements with an atomic weight greater than bismuth (thorium, protactinium and uranium, for example), had been postulated as far back as 1892. Most investigators, however, considered that these elements were analogues of the third series transition elements, hafnium, tantalum and tungsten. The existence of a second inner transition series, in the form of the actinides, was not accepted until similarities with the electron structures of the lanthanides had been established. See: van Spronsen, J. W. (1969). The periodic system of chemical elements. Amsterdam: Elsevier. p. 315–316, ISBN 0-444-40776-6.

g) See The Internet database of periodic tables for depictions of these kinds of variants.

h) But for the existence of the lanthanides the composition of group 3 would not have been a source of any special interest, since scandium, yttrium, lanthanum and actinium exhibit the same gradual change in properties as do calcium, strontium, barium and radium in group 2

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