

CHEMISTRY STUDY MATERIALS FOR CLASS 10

(Based on: Periodic Classification of Elements)

GANESH KUMAR

DATE:- 16/06/2020

NEWLANDS' LAW OF OCTAVES

Newland arranged many of the known elements in the increasing order of their atomic masses based on musical notes. He started with the element having the lowest atomic mass (hydrogen) and ended at thorium which was the 56th element.

Law of Octaves: "When elements are arranged in the increasing order of their atomic masses, the properties of every eighth element is similar to the first."

He arranged many of the known elements in the increasing order of their atomic masses. It was noticed that the eighth element was similar in properties to the first element, just like the eighth note in music - Western as well as Indian.

sa (do)	re (re)	ga (mi)	ma (fa)	pa (so)	da (la)	ni (ti)
H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co and Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce and La	Zr	—	—

GROUPS OF THE 8TH ELEMENTS

The eighth element after lithium is sodium. In many of its chemical properties it is similar to lithium. Similarly, the eighth element after sodium is potassium, whose properties are similar to sodium. The eighth element from fluorine is chlorine both of which are similar in their properties. The eighth element from nitrogen is phosphorus and both these elements are similar in properties.

Based on this observation, Newland stated his law of octaves thus 'when elements are arranged in increasing order of their atomic mass, the eighth element resembles the first in physical and chemical properties just like the eighth note on a musical scale resembles the first note'. As a result a very important conclusion was made that there is some systematic relationship between the order of atomic masses and the repetition of properties of elements. This gave rise to a new term called 'periodicity' which signifies the recurrence of characteristic properties of elements arranged in a table, at regular intervals of a period.

ACHIEVEMENTS OF THE LAW OF OCTAVES

The law of octaves was the first logical attempt to classify elements on the basis of atomic weights. Periodicity of elements was recognized for the first time.

In 1860, there was a conference of chemists in Karl Sruhe, Germany. A young Russian chemist, Dmitri Mendeleev, attending this conference, was deeply influenced by a thesis presented by Stanislao Cannizzaro, which described Cannizzaro's method of determining atomic mass of elements. Mendeleev then started working on this aspect of atomic mass and periodicity. He later on stated the law of chemical periodicity.

DEFECTS / LIMITATIONS / SHORTCOMING OF LAW OF OCTAVES

- **It was found that the Law of Octaves was applicable only upto calcium,** as after calcium every eighth element did not possess properties similar to that of the first.
- **Newlands assumed by that only 56 elements existed in nature and no more elements would be discovered in the future.** But, later on, several new elements were discovered. Newly discovered elements could not fit into the octave structure.
- **In order to fit elements Newlands adjusted two elements in the same slot into his table.** Note that cobalt and nickel are in the same slot and these are placed in the same column as fluorine, chlorine and bromine which have very different properties than these elements.
- **Newlands put some unlike elements under the same note.** Iron, which resembles cobalt and nickel in properties, has been placed far away from these elements.

Thus, Newlands' Law of Octaves worked well with lighter elements only.
