

CHEMISTRY

CLASS NOTES FOR CBSE

Chapter 09. Periodic Classification of Elements

A periodic table may be defined as the table giving the arrangement of all the known elements according to their properties so that elements with similar properties fall with the same vertical column and elements with dissimilar properties are separated.

01. Attempts to Classify Elements

- (i) **Metal and Non-Metals:** Among the earlier classification, Lavoisier classified the elements as metals and non-metals. However, this classification proved to be inadequate. In 1803, John Dalton published a table of relative atomic weights (now called atomic masses). This formed an important basis of classification of elements.
- (ii) **Dobereiner's Triads:** In 1817, J.W. Dobereiner a German Chemist gave this arrangement of elements.
- He arranged elements with similar properties in the groups of three called triads.
 - According to Dobereiner the atomic mass of the central element was merely the arithmetic mean of atomic masses of the other two elements.

For example :

Elements of the triad	Symbol	Atomic mass
Lithium	Li	7
Sodium	Na	23
Potassium	K	39

Atomic mass of sodium 23

Some examples of triads are given in the table :

S. No.	Triads	Relative atomic masses	Average of atomic masses of the first and the third element
1.	S, Se, Te	32, 79, 128	80
2.	, Br,	35.5, 80, 127	81.25
3.	Ca, Sr, Ba	40, 88, 137	88.5

Limitation of dobereiner's Classification:

- (a) Atomic mass of the three elements of some triads are almost same. e.g. Fe, Co, Ni and Ru, Rh, Pd.
- (b) It was restricted to few elements, therefore discarded.
- (iii) **Newland's Law of Octaves:** In 1866, an English chemist, John Newlands, Proposed a new system of grouping elements with similar properties.



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He tried to correlate the properties of elements with their atomic masses. He arranged the known elements in the order of increasing atomic masses. He started with the element having the lowest atomic mass (hydrogen) and ended at thorium which was the 56th element. He observed that every eight element had properties similar to that of the first.

Thus, Newlands suggested that when the elements are arranged in the order to increasing atomic masses, the properties of every eight element are a repetition of that of the first element.

Newland's arrangement of elements into 'Octaves':

Notes of Music	sa (do)	re (re)	ga (mi)	ma (fa)	pa (so)	da (la)	ni (ti)
Elements	H	Li	Be	B	C	N	O
	F	Na	Mg			P	S
		K	Ca	Cr	Ti	Mn	Fe
	CO and Ni	Cu	Zn	Y		As	Se
	Br	Rb	Sr	Ce and La	Zr	-	-

Limitation of Law of Octaves: The law of octave has the following limitation:

- The law of octaves was found to be applicable only up to calcium. It was not applicable to elements of higher atomic masses.
- Position of hydrogen along with fluorine and chlorine was not justified on the basis of chemical properties.
- Newlands placed two elements in the same slot to fit element in the table. He also placed some unlike elements under the same slot. For example, cobalt and nickel are placed in the same slot and in the column of fluorine, chlorine and bromine. But cobalt and nickel have properties quite different from fluorine, chlorine and bromine. Similarly, iron which has resemblances with cobalt and nickel in its properties has been placed far away from these elements.
- Thus, it was realized that Newlands law of octaves worked well only with lighter elements. Therefore, this classification was rejected.

Lothar Meyer Curve : He proposed that on arranging the elements in order of increasing atomic weights similarities appear at a regular interval in physical and chemical properties.

02. Mendeleev's Periodic Law

The physical and chemical properties of elements are periodic functions of their atomic weights.

Merits of Mendeleev's periodic table:-

- Mendeleev's periodic table was very helpful in remembering and studying the properties of large number of elements.
- Mendeleev's periodic table helped in correcting the atomic masses of some of the elements like gold, beryllium and platinum based on their positions in the periodic table.
- Mendeleev could predict the properties of some undiscovered elements like scandium, gallium and germanium. By this intuition, he had left gaps for the undiscovered elements while arranging elements in his periodic table.