Periodic Classification of Elements
Introduction

INTRODUCTION:

At present 118 elements are known to us. Around the year 1800, only 30 elements were known. All these had seemingly different properties.

As different elements were being discovered, scientists gathered more and more information about the properties of these elements. They found it difficult to organize all that was known about the elements. They started looking for some pattern in their properties. On the basis of which they could study such a large number of elements with ease.

WHY DO WE NEED TO CLASSIFY ELEMENTS?

Before the beginning of eighteenth century, only a very few elements were known and it was quite easy to study and remember their individual properties. However, the situation became difficult with the discovery of large number of elements in the later years. At this stage the scientists felt the need of some simple method to facilitate the study of the properties of various elements and their compounds. After numerous attempts the scientists were ultimately successful in arranging the elements in such a way so that similar elements were grouped together and different elements were separated.

EARLY ATTEMPT AT THE CLASSIFICATION OF ELEMENTS :

Dobereiners triads

In 1817, J.W. Dobereiner, a german scientist gave this arrangement of elements.

(i) He made groups of three elements having similar chemical properties called **TRIAD**.

(ii) In Dobereiner triad, atomic weight. of middle element is equal to the average atomic weight of first and third element.

Example :

Triad	Li	Na	K
Relative Atomic Mass	7	23	39

$= 23$

Dobereiner's Triads :

Triad	**Relative atomic masses respectively**	**Arithmetic mean of atomic masses of first and the third elements.**
S, Se, Te	32, 79, 128	$\frac{32+128}{2} = 80$
Cl, Br, I	35.5, 80, 127	$\frac{35.5+127}{2} = 81.25$
Ca, Sr, Ba	40, 88, 137	$\frac{40+137}{2} = 88.5$

Limitations

Dobereiner could identify only three triads from the elements known at that time. hence this system of classification into triads was not found to be useful for classifying many other elements which were not able to form any traids like all three previous triads.

Illustration 1 **The law of triad is applicable to**

(A) C, N, O **(B) H, O, N**

(C) Na, K, Rb **(D) Cl, Br, I**

Solution

(D) Cl, Br, I

llustration 2 **The law of triad is not applicable to**

(A) Cl, Br, I **(B) Na, K, Rb**

(C) S, Se, Te **(D) Ca, Sr, Ba**

Solution

(B) Na, K, Rb

Illustration 3 **X, Y, Z are three members of a Dobereiner's triad. The atomic mass of X is 7 μ and that of Y is 23 μ. What is the atomic mass of Z?**

Solution

The triads is X, Y, Z. Let the atomic mass of Z be x, then according to Dobereiner.

$$\text{Atomic mass of Y} = \frac{\text{Atomic mass of X} + \text{Atomic mass of Z}}{2}$$

$$23\ \mu = \frac{7\mu + x}{2}$$

$$x = 2 \times 23\ \mu - 7\mu = 46\ \mu - 7\ \mu = 39\ \mu$$

Therefore, the atomic mass of Z is 39 μ.

NEWLAND LAW OF OCTAVES (1865):

In 1864, John Alexander Newland, an English chemist noticed that "when elements are arranged in the increasing order of their atomic masses every eighth element had properties similar to first element".

(i) He arranged the elements in the increasing order of their atomic mass and observe that properties of every 8th element was similar to the 1st one. Like in the case of musical vowels notation.

Sa	Re	Ga	Ma	Pa	Dha	Ne	Sa
1	2	3	4	5	6	7	8

(ii) At that time inert gases were not known.

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 Na	Zr	–	–

(iii) The properties of Li are similar to 8th element i.e. Na, Be are similar to Mg and so on.

Drawback or Limitation:

- 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.
- It was assumed by **Newlands** that only 56 elements existed in nature and no more elements would be discovered in future. But later on several new elements were discovered whose properties did not fit Newland's law of Octaves.
- In order to fit elements into his table, Newland adjusted two elements in the same slot, but also put some unlike elements under the same note. Can you find examples of these from 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, Iron, which resembles cobalt and nickel in properties has been placed far away from these elements. Thus, Newland's law of Octaves worked well with lighter elements only

LOTHER MEYER'S CURVE (1869):

(i) He plotted a curve between atomic weight and atomic volume of different elements.

(ii) The following observation can be made from the curve-

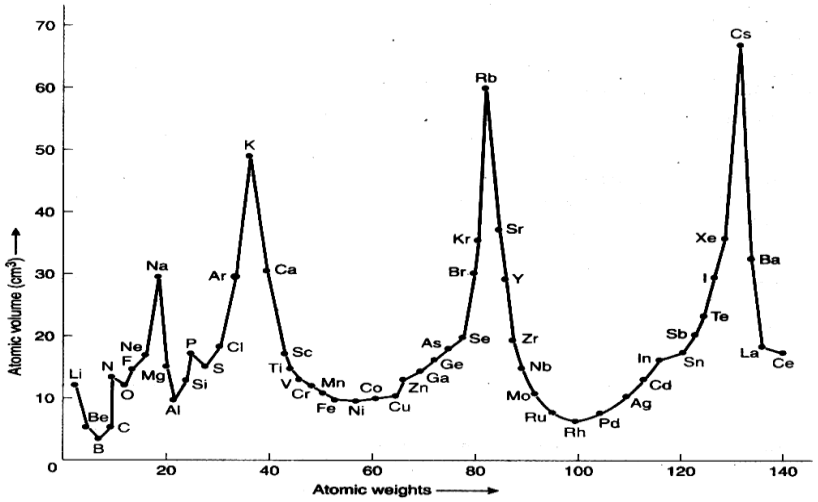
(a) Most electropositive elements i.e. Alkali metals (Li, Na, K, Rb, Cs etc.) occupy the peak positions on the curve.

(b) Less electropositive i.e. Alkaline earth metal (Be, Mg, Ca, Sr, Ba) occupy the descending position on the curve.

(c) Metalloids (B, Si, Te, At etc) and transition metals occupy bottom part of the curve.

(d) Most electronegative i.e. halogens (F, Cl, Br, I) occupy the ascending position on the curve.

Note : Elements having similar properties occupy similar position on the curve.



Conclusion:

On the basis of the curve **Lother Meyer** proposed that the physical properties of the elements are periodic function of their atomic wt. and this become the base of **Mendeleev's periodic table**.

Illustration What is periodic function.

Solution

The periodic function is a function that repeats its value (physical and chemical properties) in regular interval or periods.