

# CHEMISTRY

## CLASS NOTES FOR CBSE

### Chapter 03. Classification of Elements and Periodicity in Properties

#### 01. Need for Classification:

It is very difficult to study individually the chemistry of all the elements and millions of their compounds, hence to simplify and systematize the study of chemistry of the elements and their compounds, they are classified into groups and periods. Early attempt to classify the elements:

#### 02. Dobereiner's Law of Triads:

It was first attempt towards classification. He arranged similar elements in a group of three elements called triad and the atomic mass of the middle elements of the triad is approximately the arithmetic mean of the other two.

e.g.  $\text{Ca}^{40}$   $\text{Sr}^{87.5}$   $\text{Ba}^{137}$

$$\text{At. wt. of Sr} = \frac{137+40}{2} = 88.5$$

88.5 is nearly similar to 87.5 of atomic wt. of Sr.

Such a group of elements is called **Dobereiner's triad**.

Triad of atoms			Means of first and last element
Li	Na	K	$\frac{7+39}{2} = 23$
7	23	39	
Be	Mg	Ca	$\frac{8+40}{2} = 24$
8	24	40	

Dobereiner could arrange only a few elements as triads and there are some such elements present in a triad, whose atomic weights are approximately equal, e.g.

Fe    Co    Ni  
Ru    Rh    Pd

Therefore, this hypothesis was not acceptable for all elements.



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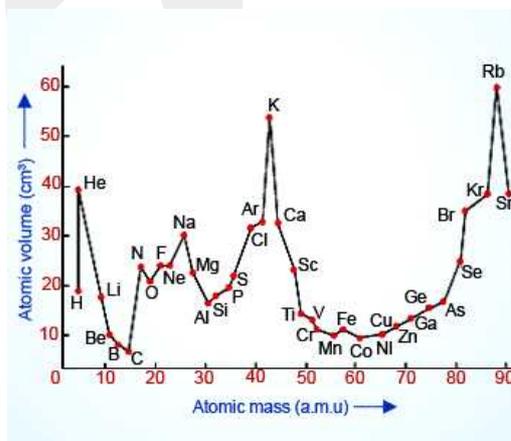
### 03. Newland's Law of Octaves:

When the lighter elements are arranged in order of their increasing atomic weights, then every eighth element is similar to the first element in its properties, similarly as the eighth note of a musical scale is similar to 1<sup>st</sup> one. e.g. Na 8<sup>th</sup> element resembles in their properties with Li. Similarly K the 8<sup>th</sup> element with Na and so on.

Name of element	Li	Be	B	C	N	O	F
	7	9	11	12	14	16	19
Name of element	Na	Mg	Al	Si	P	S	Cl
	23	24	27	28	31	32	35.5

- It is clear from the above table that sodium is the eighth element from lithium, whose properties resemble that of lithium.
- This type of classification was limited up to only 20 elements.
- Inert gas element were not discovered till then.

### 04. Lothar Mayer Arrangement:



- The graphs plotting the atomic volumes against atomic weights are known as Lothar Mayer volume curves.
- The alkali metals have highest atomic volumes.
- Alkaline earth metals (Be, Mg, Ca, Sr, Ba, etc.) which are relatively a little less electropositive. Occupy positions on the descending part of the curve.
- Halogens and the noble gases (except helium) occupy positions on the ascending part of the curve.
- Transition elements have very small volumes and therefore these are present at the bottoms of the curve.

## 05. Mendeleev's Periodic Law

### Mendeleev's Periodic Law

The physical and chemical properties of elements are the periodic function of their atomic weight.

## 06. Characteristic of Mendeleev's Periodic Table

- It is based on atomic weight
- 63 elements were known, noble gases were not discovered.
- 12 Horizontal rows are called periods.
- Vertical columns are called groups and there were 8 groups in Mendeleev's Periodic table.
- Each group up to VIIth is divided into A&B subgroups. 'A' sub groups element are called normal elements and 'B' sub groups elements are called transition elements.
- The VIIIth group was consists of 9 elements in three rows (Transition metals group).
- The elements belonging to same group exhibit similar properties.

## 07. Modified Mendeleev's Periodic Table of Elements

Reihen	Gruppe I. — R <sup>2</sup> O	Gruppe II. — RO	Gruppe III. — R <sup>2</sup> O <sup>3</sup>	Gruppe IV. RH <sup>4</sup> RO <sup>2</sup>	Gruppe V. RH <sup>5</sup> R <sup>2</sup> O <sup>3</sup>	Gruppe VI. RH <sup>6</sup> RO <sup>3</sup>	Gruppe VII. RH R <sup>2</sup> O <sup>7</sup>	Gruppe VIII. — RO <sup>4</sup>
1	H=1							
2	Li=7	Be=9.4	B=11	C=12	N=14	O=16	F=19	
3	Na=23	Mg=24	Al=27.3	Si=28	P=31	S=32	Cl=35.5	
4	K=39	Ca=40	—=44	Ti=48	V=51	Cr=52	Mn=55	Fe=56, Co=59, Ni=59, Cu=63.
5	(Cu=63)	Zn=65	—=68	—=72	As=75	Se=78	Br=80	
6	Rb=85	Sr=87	?Yt=88	Zr=90	Nb=94	Mo=96	—=100	Ru=104, Rh=104, Pd=106, Ag=108.
7	(Ag=108)	Cd=112	In=113	Sn=118	Sb=122	Te=125	J=127	
8	Cs=133	Ba=137	?Di=138	?Ce=140	—	—	—	—
9	(—)	—	—	—	—	—	—	—
10	—	—	?Er=178	?La=180	Ta=182	W=184	—	Os=195, Ir=197, Pt=198, Au=199.
11	(Au=199)	Hg=200	Tl=204	Pb=207	Bi=208	—	—	—
12	—	—	—	Th=231	—	U=240	—	—

## 08. Merits of Advantages of Mendeleev's Periodic Table

### (a) Study of elements

First time all known elements were classified in groups according to their similar properties. So study of the properties become easier of elements.



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