

## 4. Periodic Table

- The classification of elements was necessary to make their study more convenient.
- The earliest classification was based on grouping the known elements as metals and non-metals.
- Dobereiner was the first person to illustrate the relationship between the atomic masses of elements and their properties. He also formulated the Law of Triads.

Li	Ca	Cl
Na	Sr	Br
K	Ba	I

- Newlands arranged the known elements in the increasing order of their atomic masses. He also formulated the Law of Octaves. However, the Newlands' Law of Octaves is applicable only to the elements having low atomic masses.

Notes of music	sa	re	ga	ma	pa	dha	Ni
Arrangement of elements	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	—	—

- Mendeleev gave a periodic law which states that the properties of elements are a periodic function of their atomic masses.
- Achievements of Mendeleev's periodic table:
  - Mendeleev left some gaps in his periodic table so that the undiscovered elements could get a place in it without disturbing the positions of the other elements.
  - Noble metals were not discovered at that time. When they were discovered later, they got a place in Mendeleev's table without disturbing the positions of the other elements.
  - Mendeleev predicted the existence of gallium and named it as *eka*-aluminium.
- **Limitations of Mendeleev's periodic table**
  - It failed to explain the position of hydrogen.
  - It was not able to explain the position of isotopes.
  - In the table some elements having higher mass were kept before the elements having lesser atomic mass.

### Limitations of Mendeleev's periodic table

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Modern periodic law states that the properties of elements are a periodic function of their atomic numbers, not their atomic masses.

The modern periodic table consists of 7 periods and 18 groups. Elements having the same valence shell are present in the same period. Elements having the same number of valence electrons are present in the same group.



Metals are present on the left-hand side of the periodic table, whereas non-metals are present on the right hand side of the periodic table.

Group 1, 2 and 13-18: Representative elements

Group 3-12: Transition elements

Period 6: Elements with atomic numbers 58-71: Lanthanoids

Period 7: Elements with atomic numbers 90-103: Actinoids

GROUP NUMBER								18
	1	2	13	14	15	16	17	18
1	1 H Hydrogen 1.0							2 He Helium 4.0
2	3 Li Lithium 6.9	4 Be Beryllium 9.0	5 B Boron 10.8	6 C Carbon 12.0	7 N Nitrogen 14.0	8 O Oxygen 16.0	9 F Fluorine 19.0	10 Ne Neon 20.2
3	11 Na Sodium 23.0	12 Mg Magnesium 24.3	13 Al Aluminium 27.0	14 Si Silicon 28.1	15 P Phosphorus 31.0	16 S Sulphur 32.1	17 Cl Chlorine 35.5	18 Ar Argon 39.9
4	19 K Potassium 39.1	20 Ca Calcium 40.1	31 Ga Gallium 69.7	32 Ge Germanium 72.6	33 As Arsenic 74.9	34 Se Selenium 79.0	35 Br Bromine 79.9	36 Kr Krypton 83.8
5	37 Rb Rubidium 85.5	38 Sr Strontium 87.6	49 In Indium 114.8	50 Sn Tin 118.7	51 Sb Antimony 121.8	52 Te Tellurium 127.6	53 I Iodine 126.9	54 Xe Xenon 131.3
6	55 Cs Caesium 132.9	56 Ba Barium 137.3	81 Tl Thallium 204.4	82 Pb Lead 207.2	83 Bi Bismuth 209.0	84 Po Polonium (210)	85 At Astatine (210)	86 Rn Radon (222)
7	87 Fr Francium (223)	88 Ra Radium (226)	–	114 Uuq	–	Uuh	–	–

- **s-block elements:** Group 1 (alkali metals) and 2 elements (alkaline earth metals) having  $ns^1$  and  $ns^2$  outermost electronic configuration respectively
- **p-block elements:** Elements belonging to Group 13 to 18; the outermost electronic configuration varies from  $ns^2np^1$  to  $ns^2np^6$

Elements of Group 16, 17, and 18 are called chalcogens, halogens, and noble gases respectively.

- **d-block elements:** Elements belonging to Group 3 to 12

The general electronic configuration is  $(n-1)d^{1-10}ns^{0-2}$ . They are also called transition metals.

- **f-block elements** (Inner-transition metals): Lanthanoids and actinoids, with outermost electronic configuration  $(n-2)f^{1-14}(n-1)d^{0-1}ns^2$

### Metals, non-metals, and metalloids:

1. Metals are present on the left side of the periodic table and non-metals are located at the top right hand side of the periodic table.
2. The elements that exhibit properties of both metals and non-metals are called **metalloids** or **semi-metals**.

- Periodic trends:

