# PERIODIC TABLE

The periodic table can be characterized as a structured arrangement of elements in a tabular format, designed in such a manner that elements with similar properties are grouped together. This organization serves to systematically present the diverse elements, grouping them based on their shared characteristics.

## Historical Development of Periodic Table

### Development of periodic table

### 1. Prout's Hypothesis

He made a straightforward assumption that all elements are composed of hydrogen; thus, we can affirm that.

$$\text{Atomic weight of element} = n \times \frac{\text{(Atomic weight of one hydrogen atom)}}{\text{Atomic weigh of H=1}}$$

where, $n$ = number of hydrogen atom = 1, 2, 3....

### Drawback or Limitation

(a) Every element cannot be formed by Hydrogen.

(b) The atomic weights of all elements were not found as whole numbers.

**Ex.** Chlorine (atomic weight 35.5) and Strontium (atomic weight 87.5)

### 2. Dobereiner's Triad Rule

J.W. Dobereiner's highlighted that in a group of three elements with similar chemical and physical properties, the atomic weight of the middle element is the average of the other two. Examples of such triads are provided below, and he specifically noted the triad consisting of iron, cobalt, and nickel, where the atomic weights of the elements are nearly identical. Presented here are some illustrative triads proposed by Dobereiner's.

**DÖBEREINER'S TRIADS**

| Triads | | | Mean of atomic masses of 1st and 3rd elements |
|---|---|---|---|
| Li<br>7 | Na<br>23 | k<br>39 | $\frac{7+39}{2}=23$ |
| Cl<br>35.5 | Br<br>80 | I<br>127 | $\frac{35.5+127}{2}=81.25$ |
| Ca<br>40 | Sr<br>88 | Ba<br>137 | $\frac{40+137}{2}=88.5$ |
| S<br>32 | Se<br>79 | Te<br>127 | $\frac{32+127}{2}=79.5$ |
| P<br>31 | As<br>75 | Sb<br>120 | $\frac{31+120}{2}=75.5$ |
| Fe | Co | Ni | Nearly same atomic masses |
| Ru | Rh | Pd | Nearly same atomic masses |
| Os | Ir | Pt | Nearly same atomic masses |

| Triad | Li | Na | K | Ca | Sr | Ba | S | Se | Te | Cl | Br | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elements | | | | | | | | | | | | |
| Atomic weight | 7 | 23 | 39 | 40 | 88 | 137 | 32 | 80 | 128 | 35.5 | 80 | 127 |
| Mean value | | 23 | | | 88.5 | | | 80 | | | 81.25 | |

**Other Ex.** (K, Rb, Cs), (P, As, Sb) (H, F, Cl) (Sc, Y, La).

While it marked the initial successful effort to rationalize the issue, it could not be generalized or expanded.

**Drawback or Limitation:** All the known elements could not be arranged as triads.

### 3. Newland's Octet Law

John Alexander Reina, a newcomer in the field in England, made the initial endeavor to correlate the chemical properties of elements with their atomic weights.

According to him:

**(a)** If the elements are arranged in ascending order of their atomic weights, every eighth element exhibits similar properties to the first one, akin to the relationship between the first and eighth notes in music.

**For example**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sa | Re | Ga | Ma | Pa | Dha | Ni | Sa |
| Li | Be | B | C | N | O | F | Na |
| Na | Mg | Al | Si | P | S | Cl | K |

**(b)** Inert gases were not discovered till then.

**(c)** All the elements could not be classified on this basis.

### 4. Lother Meyer's Curve

(a) He graphed a curve correlating atomic weight and atomic volume for various elements.

(b) The curve yields the following observations:

(I) The most electropositive elements, i.e., alkali metals (Li, Na, K, Rb, Cs, etc.), are situated at the peak positions on the curve.

(II) Less electropositive elements, i.e., alkali earth metals (Be, Mg, Ca, Sr, Ba), are positioned on the descending section of the curve.

(III) Metalloids (B, Si, As, Te, At, etc.) and transition metals occupy the lower part of the curve.

(IV) The most electronegative elements, i.e., halogens (F, Cl, Br, I), are found on the ascending portion of the curve.

**Note:** Elements with comparable properties are situated in analogous positions on the curve.