

# PERIODIC TABLE

## **Dobereiner (1829)** ( German)

- arranged the elements which are similar in properties in “triads”, i.e. in groups of three in which the atomic mass of the middle element is approximately the average of the other two.

## **Newlands (1864)** (English)

- arranged the elements in order of increasing atomic mass such that every 8<sup>th</sup> element had similar physical and chemical properties, i.e. elements 2,9, and 16 ( Li, Na, K). He called them the Octaves and it became known as the “Law of Octaves”. Newlands did not allow for undiscovered elements or for inaccurate atomic masses, e.g. Te & I, Ar & K ( Ar was not known at the time, and Te did not fit). Newlands “law” was inadequate for elements beyond calcium and his work was not accepted by the scientific community.

## **Lothar Meyer (1869)** (German)

- plotted physical property of the elements against atomic mass. He demonstrated *periodicity*. The word periodicity is used to imply that when elements are arranged in increasing atomic number, then those having similar physical and chemical properties recur periodically, that is at regular intervals.

## **Dimitri Mendeleev (1869)** (Russian)

- listed the elements according to increasing atomic weight. He noted that elements with similar *chemical* properties appeared at regular intervals.

***Mendeleev’s Periodic Law*** : When elements are arranged in order of increasing atomic mass, elements with similar properties occur at regular intervals.

This law may also be stated as: The properties of the elements are a periodic function of their atomic mass.

( His periodic table is found on page 84 of your text book ... along with a picture of the great man.)

Mendeleev realized that the pattern was not regular and that this might be due to the fact that some elements were as yet undiscovered. He left gaps in his periodic table where the elements did not fit into the expected position, and he made allowance for inaccurate atomic masses. Where gaps came into his periodic table, he predicted the existence of these new elements and their properties. (Scandium, Gallium, Germanium.) The fact that he made these predictions and later these discoveries were made, his work has been more recognized than Newlands.

## **Rayleigh & Ramsay (1898)** ( English)

- discovered argon (“ the lazy one” in Greek). Sir William Ramsay, together with his student, Morris Travers then discovered three other noble gases: neon, krypton, and xenon - in only three months. ( Three new element in three months is a record that may never be broken!) The discovery of the noble gases helped to complete the periodic table. Their atomic masses suggested that they should be placed to the right of the halogens and not in the same group as lithium and sodium, as suggested by Mendeleev’s P.T.

### Van - der - Boek ( 1911) (Dutch)

- suggested the alteration of the periodic table ... i.e. to arrange in order of increasing *atomic number*.

### Henry Moseley (1913) (English)

- Even with the discovery of the Noble Gases and the expansion of the Periodic Table into 18 columns, some difficulties remained. In three cases the order of increasing atomic masses did not put elements in the proper chemical sequence :

Co / Ni                      Ar / K                      Te / I

Also all the rare- earth elements ( at. no. 57 - 71 ) seemed to belong to a single space between barium and hafnium.

Moseley, discovered a correlation between what he called *atomic number* and the frequency of X- rays generated by bombarding an element with high energy electrons.

He found that atomic number is a function of the property of the element rather than the atomic mass. The rare-earth elements were relegated to a space outside the proper table (in the 4f subshells) The four heaviest elements : 89 - 92 , actinium - uranium, were assigned positions in the four columns of the table follows radium. The discrepancies that puzzled earlier scientists now made sense. The atomic number of argon is 18 and that of potassium 19, so potassium should follow argon in the periodic table.

### Glenn Seaborg (1944) ( American)

- made new elements, he proposed that elements after radium were misplaced in the periodic table. Instead they should be a part of the second “ Rare - Earth” series which would contain 14 elements. The last being element 103. All of these have now been synthesized and found to fit into the periodic table. ( Elements 104 --> 109 have been synthesized

A modern P.T usually shows the atomic number along with the element symbol. Atomic number indicates the number of electrons in the atoms of an element. Electron configuration of elements helps to explain the recurrence of physical and chemical properties. Thus, the general properties and trends within a group or a period may be predicted with considerable accuracy for an element.

#### Terminology

Period :

Group (or Family):

Four Groups are given common names ...

Group 1 (1A)

Group 2 ( II A)

Group 17 (VII B)

Group 18 (VIII

Further Classification :

Metals

Non - Metals

Metalloids : Border the Zindle Line, resemble metals, however, in chemical behaviour and in properties of their compounds they are more like the non- metals.

**Only 17 of all elements are non-metals, all but five are gases: C, P<sub>4</sub>, S<sub>8</sub>, Br<sub>2</sub>, I<sub>2</sub>**

For further information, read section 5.3 pp 131-133, section 5.5-5.6 pp 134-141

Homework : p 159 # 2,6,8

Read section 5.7 pp 141 -144, section 5.8 pp 145-146

Homework : p 146 # 5-3, 5- 4, p 159 # 13

Advanced organizers : read section 5.10 pp 150 - 151