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**PERIODIC CLASSIFICATION OF ELEMENTS**

1. Dobereiner’s triads: Johann Wolfgang Dobereiner, a German chemist, classified the known elements in groups of three elements on the basis of similarities in their properties. These groups were called triads.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Characteristic of Dobereiner’s Triads: | | | |  |  |  |  |
| a. Properties of elements in each triad were similar. | | | | | |  |  |  |
| b. Atomic mass of the middle elements was roughly the average of the | | | | | | | |  |
| atomic masses of the other two elements. | | | | |  |  |  |  |
|  | Example of Dobereiner’s Triads : | | | |  |  |  |  |
| Element | | Atomic | Element |  | Atomic | Element | Atomic |  |
| mass |  | mass | mass |  |
|  |  |  |  |  |  |
| Lithium (Li) | | 6.9 | Calcium (Ca) |  | 40.1 | Chlorine | 35.5 |  |
|  | (Cl) |  |
|  |  |  |  |  |  |  |  |
| Sodium (Na) | | 23.0 | Strontium |  | 87.6 | Bromine | 79.9 |  |
| (Sr) |  | (Br) |  |
|  |  |  |  |  |  |  |
| Potassium | | 39.0 | Barium (Ba) |  | 137.3 | Iodine (I) | 126.9 |  |
| (K) |  |  |  |
|  |  |  |  |  |  |  |  |

 Limitations: Dobereiner could identify only three triads. He was not able to prepare triads of all the known elements

2. Newlands’ Law of Octaves: John Newlands, an English scientist, arranged the known elements in the order of increasing atomic masses and called it the ‘Law of Octaves’. It is known as ‘Newlands’ Law of Octaves’

* Characteristics of Newlands’ Law of Octaves

1. It contained the elements from hydrogen to thorium
2. Properties of every eighth element were similar to that of the

first element

* Table showing Newlands’ Octaves:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| sa | re | ga | ma | pa | da | ni |
| (do) | (re) | (mi) | (fa) | (so) | (la) | (ti) |
| H | Li | Be | B | C | N | O |
| F | Na | Mg | Al | Si | P | S |
| Cl | K | Ca | Cr | Ti | Mn | Fe |

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|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Co and | Cu | Zn | Y | In | As | Se |
| Ni |  |  |  |  |  |  |
| Br | Rb | Sr | Ce and | Zr | - | - |
|  |  |  | La |  |  |  |

* Limitations of Newlands’ law of Octaves:

1. The law was applicable to elements upto calcium (Ca) only
2. It contained only 56 elements. Further it was assumed by Newlands that only 56 elements existed in nature and no more elements would be discovered in the future.
3. In order to fit elements into the table. Newlands’ adjusted two

elements in the same slot and also put some unlike elements under same note. For example 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 differently away from these elements

3. Mendeleev’s Periodic Table: Dmitri Ivanovich Mendeleev, a Russian chemist, was the most important contributor to the early development of a periodic table of elements wherein the elements were arranged on the basis of their atomic mass and chemical properties..

* Characteristic of Mendeleev’s Period Table:

1. Mendeleev arranged all the 63 known elements in an increasing order of their atomic masses.
2. The table contained vertical columns called ‘groups’ and horizontal rows called ‘periods’.
3. The elements with similar physical and chemical properties came under same groups.

* Mendeleev’s Periodic Law: The properties of elements are the periodic function of their atomic masses.
* Achievements of Mendeleev’s Periodic Table:

1. Through this table, it was very easy to study the physical and chemical properties of various elements.
2. Mendeleev adjusted few elements with a slightly greater atomic mass before the elements with slightly lower atomic mass, so that elements with

similar properties could be grouped together. For example, aluminum appeared before silicon, cobalt appeared before nickel.

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c. Mendeleev left some gaps in his periodic table. He predicted the existence of some elements that had not been discovered at that time. His predictions were quite true as elements like scandium; gallium and germanium were discovered later

d. The gases like helium, neon and argon, which were discovered later, were placed in a new group without disturbing the existing order

 Limitations of Mendeleev’s Periodic Table :

* 1. He could not assign a correct position to hydrogen in the periodic table
  2. Positions of isotopes of all elements was not certain according to

Mendeleev’s periodic table

1. Atomic masses did not increase in a regular manner in going from one element to the next. So it was not possible to predict how many elements

could be discovered between two elements

1. Modern Periodic Table: Henry Moseley gave a new property of elements,

‘atomic number’ and this was adopted as the basis of Modern Periodic Table’.

* Modern Periodic Law: Properties of elements are a periodic function of their atomic number
* Position of elements in Modern Periodic Table:
  + 1. The modern periodic table consists of 18 groups and 7 periods
    2. Elements present in any one group have the same number of valence electrons. Also, the number of shells increases as we go down the group.
  1. Elements present in any one period, contain the same number of shells. Also, with increase in atomic number by one unit on moving from left to right, the valence shell electron increases by one unit

d. Each period marks a new electronic shell getting filled

* Trends in the Modern Periodic Table:
  1. Valency: Valency of an element is determined by the number of valence electrons present in the outermost shell of its atom
* Valency of elements in a particular group is same
* Valency of elements in a particular period increases by one unit from left to right with the increase in atomic number by one unit
  1. Atomic Size: Atomic size refers to the radius of an atom.

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* In a period, atomic size and radii decreases from left to right. This is due to increase in nuclear charge which tends to pull the electrons closer to nucleus and reduces size of atom
* In a group, atomic size and radii increases from top to bottom. This is because on moving down, new shells are added. This increases distance

between outermost electrons and nucleus which increases the size of atom

* 1. Metallic and Non- metallic Properties:
* The tendency to lose electrons from the outermost shell of an atom, is called metallic character of an element
* Metallic character decreases across a period and increases down the group
* The tendency to gain electron in the outermost shell of an atom, is called non- metallic character of an element
* Non-metallic character increases across a period and decreases down the group
* Elements intermediate between metal and non-metals that show characteristic of both metals and non-metals are called as semi-metals or

metalloids

1. Metals have a tendency to loose electrons while forming bond. Hence they are electropositive in nature
2. Non-metals have a tendency to gain electrons while forming bond. Hence they are electronegative in nature
3. Oxides formed by metals are generally basic and oxides formed by non-metals are generally acidic