

CHEMISTRY STUDY MATERIALS FOR CLASS 10 (NCERT Based Revision Notes of Chapter - 05)

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Periodic Classification of Elements

MODERN PERIODIC TABLE

In 1913, Henry Moseley proved that the atomic number is the fundamental property rather than its atomic mass.

Modern Periodic Law: Properties of elements are a periodic function of their atomic numbers.

The periodic table, based on the Modern Periodic Law is called the Modern Periodic Table.

The image displays the Modern Periodic Table of Elements. It is organized into groups (columns) and periods (rows). The groups are labeled at the top: 1 (1A, 11A), 2 (2A, 2A), 3 (3A, 3A), 4 (4A, 4A), 5 (5A, 5A), 6 (6A, 6A), 7 (7A, 7A), 8 (VIII, 8), 9 (9), 10 (10), 11 (1B, 1B), 12 (2B, 2B), 13 (3A, 3A), 14 (4A, 4A), 15 (5A, 5A), 16 (6A, 6A), 17 (7A, 7A), 18 (VIII, 8A). The elements are color-coded by groups. The Lanthanide Series (elements 57-71) and Actinide Series (elements 89-103) are shown below the main table.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | |
|------------------------------------|---------------------------------|---------------------------------------|-----------------------------------|------------------------------------|---------------------------------|-----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|---------------------------------|------------------------------------|-----------------------------------|--------------------------------------|------------------------------------|--------------------------------------|-------------------------------------|-----------------------------|
| 1A | 2A | 3A | 4A | 5A | 6A | 7A | VIII | 8 | 9 | 10 | 11B | 12B | 3A | 4A | 5A | 6A | 7A | 8A |
| 1 H Hydrogen 1.008 | 2 He Helium 4.0026 | | | | | | | | | | | | 5 B Boron 10.81 | 6 C Carbon 12.011 | 7 N Nitrogen 14.0074 | 8 O Oxygen 15.9994 | 9 F Fluorine 18.9984 | 10 Ne Neon 20.1798 |
| 3 Li Lithium 6.941 | 4 Be Beryllium 9.0122 | | | | | | | | | | | | 13 Al Aluminum 26.981538 | 14 Si Silicon 28.0855 | 15 P Phosphorus 30.973762 | 16 S Sulfur 32.06 | 17 Cl Chlorine 35.4527 | 18 Ar Argon 39.948 |
| 11 Na Sodium 22.98976928 | 12 Mg Magnesium 24.304 | 13 Sc Scandium 44.955912 | 14 Ti Titanium 47.88 | 15 V Vanadium 50.9415 | 16 Cr Chromium 51.9961 | 17 Mn Manganese 54.938 | 18 Fe Iron 55.847 | 19 Co Cobalt 58.9332 | 20 Ni Nickel 58.6934 | 21 Cu Copper 63.546 | 22 Zn Zinc 65.38 | 23 Ga Gallium 69.723 | 24 Ge Germanium 72.64 | 25 As Arsenic 74.9216 | 26 Se Selenium 78.96 | 27 Br Bromine 79.904 | 28 Kr Krypton 83.80 | |
| 19 K Potassium 39.0983 | 20 Ca Calcium 40.078 | 21 Sc Scandium 44.955912 | 22 Ti Titanium 47.88 | 23 V Vanadium 50.9415 | 24 Cr Chromium 51.9961 | 25 Mn Manganese 54.938 | 26 Fe Iron 55.847 | 27 Co Cobalt 58.9332 | 28 Ni Nickel 58.6934 | 29 Cu Copper 63.546 | 30 Zn Zinc 65.38 | 31 Ga Gallium 69.723 | 32 Ge Germanium 72.64 | 33 As Arsenic 74.9216 | 34 Se Selenium 78.96 | 35 Br Bromine 79.904 | 36 Kr Krypton 83.80 | |
| 37 Rb Rubidium 85.4678 | 38 Sr Strontium 87.62 | 39 Y Yttrium 88.90584 | 40 Zr Zirconium 91.224 | 41 Nb Niobium 92.90638 | 42 Mo Molybdenum 95.94 | 43 Tc Technetium 98.9062 | 44 Ru Ruthenium 101.07 | 45 Rh Rhodium 101.07 | 46 Pd Palladium 106.36 | 47 Ag Silver 107.8682 | 48 Cd Cadmium 112.411 | 49 In Indium 114.818 | 50 Sn Tin 118.71 | 51 Sb Antimony 121.757 | 52 Te Tellurium 127.6 | 53 I Iodine 126.90447 | 54 Xe Xenon 131.29 | |
| 55 Cs Cesium 132.90545196 | 56 Ba Barium 137.327 | 57-71 Lanthanide Series | 72 Hf Hafnium 178.49 | 73 Ta Tantalum 180.94788 | 74 W Tungsten 183.84 | 75 Re Rhenium 186.207 | 76 Os Osmium 190.23 | 77 Ir Iridium 192.22 | 78 Pt Platinum 195.084 | 79 Au Gold 196.966569 | 80 Hg Mercury 200.59 | 81 Tl Thallium 204.3833 | 82 Pb Lead 207.2 | 83 Bi Bismuth 208.980389 | 84 Po Polonium 209 | 85 At Astatine 209 | 86 Rn Radon 222 | |
| 87 Fr Francium 223 | 88 Ra Radium 226 | 89-103 Actinide Series | 104 Rf Rutherfordium 261 | 105 Db Dubnium 262 | 106 Sg Seaborgium 266 | 107 Bh Bohrium 264 | 108 Hs Hassium 265 | 109 Mt Meitnerium 268 | 110 Ds Darmstadtium 271 | 111 Rg Roentgenium 272 | 112 Cn Copernicium 277 | 113 Uut Ununtrium unknown | 114 Fl Flerovium [289] | 115 Uup Ununpentium unknown | 116 Lv Livermorium [289] | 117 Uus Ununseptium unknown | 118 Uuo Ununoctium unknown | |
| 57 La Lanthanum 138.90547 | 58 Ce Cerium 140.12 | 59 Pr Praseodymium 140.90766 | 60 Nd Neodymium 144.24 | 61 Pm Promethium 144.9127 | 62 Sm Samarium 150.36 | 63 Eu Europium 151.964 | 64 Gd Gadolinium 157.25 | 65 Tb Terbium 158.92534 | 66 Dy Dysprosium 162.5 | 67 Ho Holmium 164.93032 | 68 Er Erbium 167.255 | 69 Tm Thulium 168.9304 | 70 Yb Ytterbium 173.054 | 71 Lu Lutetium 174.967 | | | | |
| 89 Ac Actinium | 90 Th Thorium | 91 Pa Protactinium | 92 U Uranium | 93 Np Neptunium | 94 Pu Plutonium | 95 Am Americium | 96 Cm Curium | 97 Bk Berkelium | 98 Cf Californium | 99 Es Einsteinium | 100 Fm Fermium | 101 Md Mendelevium | 102 No Nobelium | 103 Lr Lawrencium | | | | |

Modern Periodic Table

POSITION OF ELEMENTS IN THE PERIODIC TABLE

Periods

1. The horizontal rows in the Modern Periodic Table are called periods.
2. The Modern Periodic Table consists of seven periods which are numbered from 1st to 7th.
3. In each period, a new shell starts filling up. The period number is also the number of shell which starts filling up.
4. The elements in a period have consecutive atomic numbers, and the number of elements in each period is given below
 - First period contains 2 elements and is called a very short period.
 - Second and third periods contain 8 elements and are called as short periods.
 - Fourth and fifth periods are long periods and contain 18 elements each.
 - Sixth and seven periods are the longest and contains 32 elements.

The number of elements present in each period is given in the following table.

| Period | Valence shell | Type of period | No of elements | Atomic No of the elements |
|------------------------|---------------|----------------|----------------|---------------------------|
| 1 st Period | n = 1 | Short period | 2 | Atomic number 1 and 2 |
| 2 nd Period | n = 2 | Short period | 8 | Atomic number 3 to 10 |
| 3 rd Period | n = 3 | Long period | 8 | Atomic number 11 to 18 |
| 4 th Period | n = 4 | Long period | 18 | Atomic number 19 to 36 |
| 5 th Period | n = 5 | Long period | 18 | Atomic number 37 to 54 |
| 6 th Period | n = 6 | Longest period | 32 | Atomic number 55 to 86 |
| 7 th Period | n = 7 | Longest period | 32 | Atomic number 87 to 118 |

The number of elements in these periods is based on the way electrons are filled into various shells. The maximum number of electrons that can be accommodated in a shell depends on the formula $2n^2$ where 'n' is the number of the given shell from the nucleus.

Groups

1. The vertical columns are called groups and consist of eighteen groups numbered from 1 to 18.
2. Elements having the same number of valence electrons are present in the same group.
3. Elements present in the same group show the same chemical properties.
4. Group 1 contains alkali metals and these elements contain 1 electron in their outermost shell.
5. Group 2 contains alkaline earth metals and these elements contain 2 electrons in their outermost shell.
6. Groups 3 to 12 have their two outermost shells incomplete.
7. Groups 13 to 18 group contain 3 to 8 electrons in their outermost shell.
8. Group 18 elements have complete outermost shells. So they are called noble elements or noble gases.
9. The element hydrogen has been placed at the top of group 1 because its electronic configuration is similar to alkali metals.

Cause of Periodicity of Elements

The modern periodic table is based on the electronic configuration of the elements. The properties of an element are determined largely by the electrons in its outermost or valence shell. Valence electrons interact with other atoms and take part in all chemical reactions, while inner shell electrons have little influence on the properties of elements. When elements are placed in the order of their increasing atomic number, the elements having the same number of valence shell electrons is repeated in such a way, so as to fall under the same group. Since, the electronic configuration of the valence shell electrons is same they show similar properties. Members of the same group have similar electronic configuration of the valence shell and thus show same valency.

Magic Numbers

When the elements are arranged in the order of increasing atomic number, it is observed that the elements with similar properties recur after intervals of either 2 or 8 or 18 or 32 elements. These numbers(2,8,18,32) are called magic numbers.

POSITION OF ELEMENTS IN THE MODERN PERIODIC

On the basis of electronic configuration, the elements of the periodic table are classified into:

- | | | |
|------------------|--------------------|------------------------------|
| 1. Noble gases | 2. Normal elements | 3. Transition elements |
| 4. Alkali metals | 5. Halogens | 6. Inner-transition elements |

Noble Gases

Noble gases are also known as inert gases and do not take part in chemical reactions. They have their outermost shell complete and thus remain stable. They do not generally combine with other substances, nor are they affected by oxidising agents or by reducing agents. They are placed in the 18 or VIIIA group. Since, the outermost shell is complete, the valency is zero, and hence VIIIA group is also referred to as zero group.

Normal Elements

In the case of these elements, all shells except the outermost shell are completely filled. Elements belonging to 1 (IA), 2 (IIA), 3 (IIIA), 4 (IVA), 5 (VA), 6 (VIA) and 7 (VIIA) are normal elements. Elements of the second period are known as typical elements [Li ($Z = 3$) to Ne ($Z = 10$)] because each element is placed in a group whose number matches with the number of valence electrons. The elements of the IIIrd period are representative elements [Na ($Z = 11$) to Ar ($Z = 18$)] as each of them is a representative of its group. Groups 1 (IA) and 2 (IIA) are strongly metallic and are called group of 'alkali metals and alkaline earth metals', while group 7 (VIIA) are halogens.
