

SHAHID MATANGINI HAZRA GOVT. COLLEGE FOR WOMEN

Prepared

Basudev Mandal

Asst. Professor

Department of Chemistry

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PERIODIC TABLE OF ELEMENTS

1 H Hydrogen Nonmetal																	2 He Helium Noble Gas						
3 Li Lithium Metal	4 Be Beryllium Metal																	5 B Boron Metalloid	6 C Carbon Nonmetal	7 N Nitrogen Nonmetal	8 O Oxygen Nonmetal	9 F Fluorine Nonmetal	10 Ne Neon Noble Gas
11 Na Sodium Metal	12 Mg Magnesium Metal																	13 Al Aluminum Metal	14 Si Silicon Metalloid	15 P Phosphorus Nonmetal	16 S Sulfur Nonmetal	17 Cl Chlorine Nonmetal	18 Ar Argon Noble Gas
19 K Potassium Metal	20 Ca Calcium Metal	21 Sc Scandium Transition Metal	22 Ti Titanium Transition Metal	23 V Vanadium Transition Metal	24 Cr Chromium Transition Metal	25 Mn Manganese Transition Metal	26 Fe Iron Transition Metal	27 Co Cobalt Transition Metal	28 Ni Nickel Transition Metal	29 Cu Copper Transition Metal	30 Zn Zinc Transition Metal	31 Ga Gallium Metal	32 Ge Germanium Metalloid	33 As Arsenic Metalloid	34 Se Selenium Nonmetal	35 Br Bromine Nonmetal	36 Kr Krypton Noble Gas						
37 Rb Rubidium Metal	38 Sr Strontium Metal	39 Y Yttrium Transition Metal	40 Zr Zirconium Transition Metal	41 Nb Niobium Transition Metal	42 Mo Molybdenum Transition Metal	43 Tc Technetium Transition Metal	44 Ru Ruthenium Transition Metal	45 Rh Rhodium Transition Metal	46 Pd Palladium Transition Metal	47 Ag Silver Transition Metal	48 Cd Cadmium Transition Metal	49 In Indium Metal	50 Sn Tin Metal	51 Sb Antimony Metalloid	52 Te Tellurium Metalloid	53 I Iodine Nonmetal	54 Xe Xenon Noble Gas						
55 Cs Cesium Metal	56 Ba Barium Metal	•	72 Hf Hafnium Transition Metal	73 Ta Tantalum Transition Metal	74 W Tungsten Transition Metal	75 Re Rhenium Transition Metal	76 Os Osmium Transition Metal	77 Ir Iridium Transition Metal	78 Pt Platinum Transition Metal	79 Au Gold Transition Metal	80 Hg Mercury Transition Metal	81 Tl Thallium Metal	82 Pb Lead Metal	83 Bi Bismuth Metalloid	84 Po Polonium Metalloid	85 At Astatine Nonmetal	86 Rn Radon Noble Gas						
87 Fr Francium Metal	88 Ra Radium Metal	**	104 Rf Rutherfordium Transition Metal	105 Db Dubnium Transition Metal	106 Sg Seaborgium Transition Metal	107 Bh Bohrium Transition Metal	108 Hs Hassium Transition Metal	109 Mt Meitnerium Transition Metal	110 Ds Darmstadtium Transition Metal	111 Rg Roentgenium Transition Metal	112 Cn Copernicium Transition Metal	113 Nh Nihonium Metal	114 Fl Flerovium Metal	115 Mc Moscovium Metal	116 Lv Livermorium Metal	117 Ts Tennessine Nonmetal	118 Og Oganesson Noble Gas						
		•	57 La Lanthanum Lanthanide	58 Ce Cerium Lanthanide	59 Pr Praseodymium Lanthanide	60 Nd Neodymium Lanthanide	61 Pm Promethium Lanthanide	62 Sm Samarium Lanthanide	63 Eu Europium Lanthanide	64 Gd Gadolinium Lanthanide	65 Tb Terbium Lanthanide	66 Dy Dysprosium Lanthanide	67 Ho Holmium Lanthanide	68 Er Erbium Lanthanide	69 Tm Thulium Lanthanide	70 Yb Ytterbium Lanthanide	71 Lu Lutetium Lanthanide						
		**	89 Ac Actinium Actinide	90 Th Thorium Actinide	91 Pa Protactinium Actinide	92 U Uranium Actinide	93 Np Neptunium Actinide	94 Pu Plutonium Actinide	95 Am Americium Actinide	96 Cm Curium Actinide	97 Bk Berkelium Actinide	98 Cf Californium Actinide	99 Es Einsteinium Actinide	100 Fm Fermium Actinide	101 Md Mendelevium Actinide	102 No Nobelium Actinide	103 Lr Lawrencium Actinide						

1
H
Hydrogen
Nonmetal

Atomic Number
Symbol
Name
Chemical Group Block

WHY ARRANGE ELEMENTS IN A TABLE ?

- Seeing chemical elements arranged in the modern periodic table is as familiar as seeing a map of the world, but it was not always so obvious.
- The creator of the periodic table, Mendeleev, in 1869 began collecting and sorting known properties of elements, like he was playing a game, while traveling by train. He noticed that there were groups of elements that exhibited similar properties, but he also noticed that there were plenty of exceptions to the emerging patterns.

HISTORY OF THE DEVELOPMENT OF PERIODIC TABLE

- **Dobereiner's law of triads:**
- **Dobereiner's law of triads** stated by **Dobereiner** in 1817 is as follows “the atomic mass of the middle element of a **triad** is the arithmetic mean of the atomic masses of the other two elements”.
- Examples: such **triads are** lithium-sodium-potassium, chlorine-bromine-iodine, calcium-strontium-barium, and sulfur-selenium-tellurium etc.

HISTORY OF THE DEVELOPMENT OF PERIODIC TABLE

- Newland's law of octaves:
- Newland's law of octaves stated by Newland's in 1864 is as follows if the chemical elements are arranged according to increasing atomic weight, those with similar physical and chemical properties occur after each interval of seven elements.
- Examples: H to F & F to Cl are octaves of eight elements, the eighth element repeating the properties of the first.

HISTORY OF THE DEVELOPMENT OF PERIODIC TABLE

- **Mendeleev's periodic law:**
- **Mendeleev's periodic law** stated by Mendeleev in 1869 is as follows “The physical and chemical properties of all the elements are a periodic function of their atomic masses”
- **Demerits of Mendeleev’s Periodic Table:**
- **Mendeleev** placed many elements in wrong order of their increasing atomic masses in order to place elements having similar properties in similar group.
- **Example:** The atomic mass of nickel is less than that of cobalt; in spite of that cobalt is placed before nickel.

HISTORY OF THE DEVELOPMENT OF PERIODIC TABLE

- **Modern Periodic Law:**
- The modern periodic law stated by Henry Moseley in 1912 is as follows
- “The physical and chemical properties of elements are periodic functions of their atomic numbers”
- This means that there occurs a periodic recurrence in physical and chemical properties of elements when they are arranged on the basis of their increasing atomic numbers

EFFECTIVE NUCLEAR CHARGE

- **Effective Nuclear Charge:**

The **effective nuclear charge** (often symbolized as Z_{eff}) is the net positive charge experienced by an electron in a poly electronic atom. The term "effective" is used because the shielding effect of negatively charged electrons prevents higher orbital electrons from experiencing the full nuclear charge of the nucleus due to the repelling effect of inner-layer-electrons.

PRINCIPLE OF SLATER'S RULES

- Principle of Slater's Rules :

The general principle behind Slater's Rule is that the actual charge felt by an electron is equal to what you would expect the charge to be from a certain number of protons, but minus a certain amount of charge from other electrons.

- Slater's rules allow you to estimate the effective nuclear charge Z_{eff} from the real number of protons in the nucleus and the effective shielding of electrons in each orbital shell

STEPS OF SLATER'S RULES

- Slater's Rules :
- **Step 1:** Write the electron configuration of the atom in the following form:
(1s) (2s, 2p) (3s, 3p) (3d) (4s, 4p) (4d) (4f) (5s, 5p) . . .
- **Step 2:** Identify the electron of interest, and ignore all electrons in higher groups (to the right in the list from Step 1). These do not shield electrons in lower groups
- **Step 3:** Slater's Rules is now broken into two cases:
 - the shielding experienced by an s- or p- electron,
 - electrons within same group shield **0.35**, except the 1s which shield **0.30**
 - electrons within the n-1 group shield **0.85**
 - electrons within the n-2 or lower groups shield **1.00**
 - the shielding experienced by nd or nf valence electrons
 - electrons within same group shield **0.35**
 - electrons within the lower groups shield **1.00**

SHIELDING EFFECT AND PENETRATION

- **Shielding And Penetration:**
- Electrons are negatively charged and are pretty close to each other, which means that they can repel each other. The repulsion an electron feels is **shielding** and the attraction it feels to the nucleus is **penetration**.
- **Shielding Effect:** If an electron is far from the nucleus, then at any given moment, many of the other electrons present *between* that electron and the nucleus decrease the attractive interaction between it and the electron farther away. As a result, the electron farther away experiences an effective nuclear charge (Z_{eff}) that is less than the actual nuclear charge Z . This effect is called electron shielding.



YOU

THANK