For XAT, CMAT, MAT, IIFT Exam

PERIODIC CLASSIFICATION OF ELEMENTS

- In 1800, there were only 31 known elements. By 1865, their number became 63. Now 118 elements have been discovered.
- Presently, **118** elements are known. All these have different Properties. Out of these 118, only 94 are naturally occurring.
- All the elements are unique in their nature and property. To categorize these elements according to their properties, scientists started to look for a way.
- Scientists made several attempts to classify elements according to their properties Such as Newlands Law of Octaves, Dobereiner triads Law and Mendeleev

DOBEREINER'STRIADS LAW

- He tried to arrange the elements with similar properties into groups. He identified some groups having three elements each. So he called these groups 'triads' Dobereiner showed that when the three elements in a triad were written in the order of increasing atomic masses. The atomic mass of the middle element was roughly the average of the atomic masses of the other two elements
- **Example**: In the triad group (1), arithmetic mean of atomic masses of 1st and 3rd elements, (6.9 + 39.1)/2 = 23. So the atomic mass of Na (middle element) is 23.

Limitations

- Dobereiner could identify only three triads from the elements known at that time and all elements could not be classified in the form of triads. "
- The law was not applicable to elements having very low and very high atomic mass.

Newlands Law of Octaves

• In 1866, John Newlands arranged **56 known elements** in the increasing order of their atomic mass.

- He started with the element having the lowest atomic mass (hydrogen) and ended at thorium which was the 56th element. He found that every eighth element had properties similar to that of the first. This arrangement was known as 'law of octaves'
- Law of Octaves was applicable only upto calcium, as after calcium every eighth element did not possess properties similar to that of the first.
- Newlands' Law of Octaves worked well with lighter elements only
- Newlands' table was restricted to only 56 elements and did not leave any room for new elements

Mendeleev periodic table

- At the time of Mendeleev started his work, **63** elements were known. He examined the relationship between the atomic masses of the elements and their physical and chemical properties
- He observed that most of the elements got a place in a Periodic Table and were arranged in the order of their increasing atomic masses
- Mendeleev's Periodic Table contains vertical columns called 'groups' and horizontal rows called 'periods'
- It has eight vertical columns called 'groups' and seven horizontal rows called 'period'.

Limitations

- The increasing order of atomic mass was not strictly followed throughout.
 Eg. Co & Ni, Te & I.
- No place for isotopes in the periodic table
- No proper position could be given to the element hydrogen. Non-metallic hydrogen was placed along with metals like lithium (Li), sodium (Na) and potassium (K).

Modern Periodic Table

- Elements are arranged in order of **increasing atomic number**
- Modern Periodic Law can be stated as follows "The chemical and physical properties of the elements are the periodic functions of their atomic numbers". Based on the modern periodic law, the modern periodic table is derived
- Modern Periodic Table has 18 vertical columns known as groups and 7 horizontal rows known as 'periods'.
- Elements present in any one group have the same number of valence electrons

- The valence of an element is determined by the number of valence electrons present in the outermost shell of its atom
- Metals are found on the left-hand side of the Periodic Table
- Non-metals are found on the right-hand side of the Periodic Table
- Modern Periodic Table, a zig-zag line separates metals from non-metals. The borderline elements boron, silicon, germanium, arsenic, antimony, tellurium and polonium are intermediate in properties and are called **metalloids**
- Halogens are located on the 17th group on the periodic table
- Noble gases are located on the 18th group on the periodic table
- Based on the physical and chemical properties of elements, they are grouped into various families.

Groups in modern periodic table

Group 1	Alkali metals
Group 2	Alkaline earth metals
Group 3 o 12	Transition metals
Group 13	Boron Family
Group 14	Carbon Family
Group 15	Nitrogen Family
Group 16	Oxygen Family (or) Chalcogen Family
Group 17	Halogens
Group 18	Noble gases

Group → ↓ Period	▶ 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 0	9 F	10 Ne
3	11 Na	12 Mg											13 A1	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba		72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 T1	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra		104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 F1	115 Mc	116 Lv	117 Ts	118 Og
	L	anthan	ides	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 ТЪ	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
		Actir	nides	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

Modern Periodic Table

Position of hydrogen in the periodic table

- Hydrogen is the lightest, smallest and first element of the periodic table. Its electronic configuration (1s1) is the simplest of all the elements.
- It occupies a unique position in the periodic table. It behaves like alkali metals as well as halogens in its properties
- In the periodic table, it is placed at the top of the alkali metals.
 - 1. Hydrogen can lose its only one electron to form a hydrogen ion (H+) like alkali metals.
 - 2. It can also gain one electron to form the hydride ion (H-) like halogens.
 - 3. Alkali metals are solids while hydrogen is a gas
- The position of hydrogen in the modern periodic table is still under debate as the properties of hydrogen are unique.

Position of Noble gases in the periodic table

• The elements Helium, Neon, Argon, Krypton, Xenon and Radon of group 18 in the periodic table are called as Noble gases or Rare gases. They are monoatomic gases and do not react with other substances easily, due to completely filled subshells. Hence they are called as inert gases. They are found in very small quantities and hence they are called as rare gases.

ATOMIC NUMBERS

Atomic number	Symbol	Elements
1	Н	Hydrogen
2	He	Helium
3	Li	Lithium
4	Be	Beryllium
5	В	Boron
6	С	Carbon
7	Ν	Nitrogen
8	0	Oxygen
9	F	Fluorine
10	Ne	Neon
11	Na	Sodium
12	Mg	Magnesium
13	Al	Aluminum
14	Si	Silicon
15	Р	Phosphorus
16	S	Sulfur
17	Cl	Chlorine
18	Ar	Argon
19	К	Potassium
20	Ca	Calcium
21	Sc	Scandium
22	Ti	Titanium
23	V	Vanadium
24	Cr	Chromium
25	Mn	Manganese
26	Fe	Iron
27	Со	Cobalt
28	Ni	Nickel
29	Cu	Copper

30	Zn	Zinc
31	Ga	Gallium
32	Ge	Germanium
33	As	Arsenic
34	Se	Selenium
35	Br	Bromine
36	Kr	Krypton
37	Rb	Rubidium
38	Sr	Strontium
39	Y	Yttrium
40	Zr	Zirconium
41	Nb	Niobium
42	Мо	Molybdenum
43	Тс	Technetium
44	Ru	Ruthenium
45	Rh	Rhodium
46	Pd	Palladium
47	Ag	Silver
48	Cd	Cadmium
49	In	Indium
50	Sn	Tin
51	Sb	Antimony
52	Те	Tellurium
53	Ι	Iodine
54	Xe	Xenon
55	Cs	Cesium
56	Ba	Barium
57	La	Lanthanum
58	Се	Cerium
59	Pr	Praseodymium

60	Nd	Neodymium
61	Pm	Promethium
62	Sm	Samarium
63	Eu	Europium
64	Gd	Gadolinium
65	Tb	Terbium
66	Dy	Dysprosium
67	Но	Holmium
68	Er	Erbium
69	Tm	Thulium
70	Yb	Ytterbium
71	Lu	Lutetium
72	Hf	Hafnium
73	Та	Tantalum
74	W	Tungsten
75	Re	Rhenium
76	Os	Osmium
77	Ir	Iridium
78	Pt	Platinum
79	Au	Gold
80	Hg	Mercury
81	Tl	Thallium
82	Pb	Lead
83	Bi	Bismuth
84	Ро	Polonium
85	At	Astatine
86	Rn	Radon
87	Fr	Francium
88	Ra	Radium
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	
104	Rf	Rutherfordium	
105	Db	Dubnium	
106	Sg	Seaborgium	
107	Bh	Bohrium	
108	Hs	Hassium	
109	Mt	Meitnerium	
110	Ds	Darmstadtium	
111	Rg	Roentgenium	
112	Cn	Copernicium	
113	Nh	Nihonium	
114	Fl	Flerovium	
115	Мс	Moscovium	
116	Lv	Livermorium	
117	Ts	Tennessine	
118	Og	Oganesson	