

## Unit 1 : lesson 2 : Periodic table for classification of elements

Chemical elements differ in physical properties and chemical properties... Therefore, there have been multiple attempts to classify the elements, and their goal is to facilitate study and find the relationship between the elements and their physical and chemical properties.

### The most important attempts to classify elements:-

1) The periodic table of the scientist Mendeleev

2) The periodic table of the scientist Moseley

3) The modern periodic table

### 1) The periodic table of the scientist Mendeleev...

- The scientist Mendeleev's table is considered the first true periodic table for classifying elements...
- The elements are arranged in ascending order according to their atomic mass, without a regular progression when moving from left to right in horizontal rows.
- He discovered that the properties of the elements are repeated periodically at the beginning of each new row.. This means that the elements that exist in the form of vertical columns are similar in properties

Periodic Table of Elements  
based on Mendeleev's Periodic Law

0	I	II	III	IV	V	VI	VII	VIII			
He 4.00	H 1.01	Li 6.94	Be 9.01	B 10.8	C 12.0	N 14.0	O 16.0	F 19.0			
Ne 20.2	Na 23.0	Mg 24.3	Al 27.0	Si 28.1	P 31.0	S 32.1	Cl 35.5				
Ar 40.0	K 39.1	Ca 40.1	Sc 45.0	Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	Fe 55.9	Co 58.9	Ni 58.7	
Kr 83.8	Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9	Tc (98)	Ru 101	Rh 103	Pd 106	
Xe 131	Ce 133	Ba 137	La 139	Hf 178	Ta 181	W 184	Re 186	Os 194	Ir 192	Pt 195	
Rn (222)	Fr (223)	Ra (226)	Ac (227)	Th 232	Pa (231)	U 238					

Legend:  
Yellow: Lanthanide series  
Blue: Actinide series  
Red: Known to Ancients  
Blue: Known to Mendeleev  
Green: Dobereiner's triads

## 2) The periodic table of the scientist Moseley...

- After the discovery of protons by the scientist Rutherford, the scientist Moseley discovered that the periodicity of the properties of elements is related to their atomic numbers and not to the atomic mass.
- Moseley modified Mendeleev's table in which the elements were arranged in ascending order according to their atomic number.
- Each element exceeds the element that precedes it in the same period by one integer
- Moseley added to the scientist Mendeleev's table the group of inert gases and other new elements that were discovered after the publication of Mendeleev's table.

1	2											3	4	5	6	7	0
H																He	
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac															

## 3) The modern periodic table:-

- The elements are arranged in ascending order according to their atomic numbers and the method of filling the sub-energy levels with electrons.

**Periodic Table of the Elements**

1 11A 11A	2 IIA 2A											13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	18 VIIIA 8A
1 H Hydrogen 1.0079	4 Be Beryllium 9.01218											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.998403	10 Ne Neon 20.1797
11 Na Sodium 22.989768	12 Mg Magnesium 24.305	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8 VIII 8	9 VIII 8	10 VIII 8	11 IB 1B	12 IIB 2B	13 Al Aluminum 26.981539	14 Si Silicon 28.0855	15 P Phosphorus 30.973762	16 S Sulfur 32.066	17 Cl Chlorine 35.4527	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.95591	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 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.64	33 As Arsenic 74.92159	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 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium 98.9072	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.9055	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.90447	54 Xe Xenon 131.29
55 Cs Cesium 132.90543	56 Ba Barium 137.327	57-71 Lanthanide Series	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.9665	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98037	84 Po Polonium [209]	85 At Astatine 208.9871	86 Rn Radon 222.0176
87 Fr Francium 223.0197	88 Ra Radium 226.0254	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 [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Uut Ununtrium unknown	114 Fl Flerovium [289]	115 Uup Ununpentium unknown	116 Lv Livermorium [288]	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown
		57 La Lanthanum 138.905	58 Ce Cerium 140.115	59 Pr Praseodymium 140.90766	60 Nd Neodymium 144.24	61 Pm Promethium 144.9127	62 Sm Samarium 150.36	63 Eu Europium 151.965	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92534	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93032	68 Er Erbium 167.26	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967	
		89 Ac Actinium 227.0278	90 Th Thorium 232.0381	91 Pa Protactinium 231.03688	92 U Uranium 238.0289	93 Np Neptunium 237.0482	94 Pu Plutonium 244.0642	95 Am Americium 243.0614	96 Cm Curium 247.0703	97 Bk Berkelium 247.0703	98 Cf Californium 251.0798	99 Es Einsteinium [254]	100 Fm Fermium 257.0851	101 Md Mendelevium 258.1	102 No Nobelium 259.1069	103 Lr Lawrencium [262]	
		Alkali Metals	Alkaline Earths	Transition Metals	Basic Metals	Semi-Metals	Nonmetals	Halogens	Noble Gases	Lanthanides	Actinides						

## Description of the modern periodic table:-

- The modern periodic table consists of 7 horizontal period and 18 vertical groups

( 7 cycles because the number of energy levels is 7 levels... In each cycle we begin to fill a new energy level with electrons )

- The number of elements in the modern periodic table is 118

Elements are found in 4 basic Blocks: S, P, D, and F

### Block s elements:-

BYJU'S

S-block elements

H	He																	He
Li	Be											B	C	N	O	F	Ne	
Na	Mg											Al	Si	P	S	Cl	Ar	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og	
		Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu			
		Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr			

- Location: left of the modern periodic table

- It consists of two vertical groups: 1A and 2A

( 1A alkali metals , 2A are called alkaline earth metals )

- All of its elements are solid metals except hydrogen, which is not a gas metal.

### Block p elements:-

P-BLOCK ELEMENTS

BYJU'S

H	He																	He
Li	Be											B	C	N	O	F	Ne	
Na	Mg											Al	Si	P	S	Cl	Ar	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og	
		Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu			
		Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr			

- Location: Right of the modern periodic table
- It consists of 6 groups starting with group 3A and ending with group zero
- Most of its elements are non-metals, in addition to metalloids and some other metals
- Its elements exist in solid and gaseous forms, with the exception of bromine (Br), which is a liquid nonmetal
- One of its most important groups is the penultimate group 7A, which is called the halogens, and the last group (zero) is called the noble gases.

### Block d Elements

- Location: in the middle of the modern periodic table
- It consists of 10 groups starting with Group 3B and ending with Group 2B
- It begins to appear in the fourth period and its elements are called transitional elements
- All of its elements are metallic elements in the solid state, except for mercury ( Hg ), which is a liquid fluid element

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	H												B	C	N	O	F	Ne	
2	Li	Be											Al	Si	P	S	Cl	Ar	
3	Na	Mg											Ga	Ge	As	Se	Br	Kr	
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
7	Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og	
			<b>f-block elements</b>																
			Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu			
			Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr			

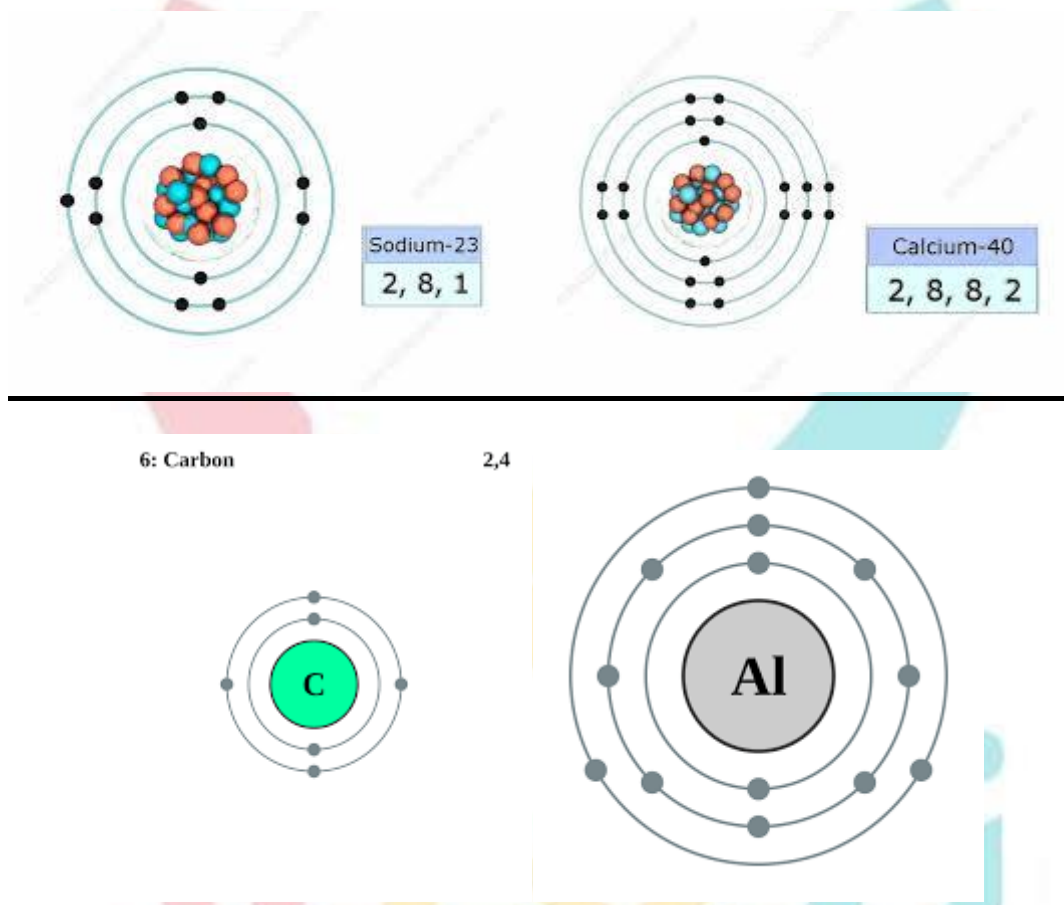
### Block f Elements

- Location at the bottom of the modern periodic table
- It consists of two series: the lanthanide series and the actinide series.
- All of its elements are metallic elements.

**The location of the elements in the groups symbolized by the symbol A can be determined by the atomic number...**

**(1) The electron configuration of the atom is determined ( The number of energy levels is the period number )**

**(2) The number of electrons in the last energy level determines the group number (we put the letter A next to the number of electrons in the last energy level)**



${}_{11}\text{Na} : 2, 8, 1$  period 3 / group 1A

${}_{20}\text{Ca} : 2, 8, 8, 2$  period 4 / group 2A

${}_{6}\text{C} : 2, 4$  period 2 / group 4A

${}_{13}\text{Al} : 2, 8, 3$  period 3 / group 3A

**Exercises : Complete the following phrases:-**

- 1) The period number is equal to the number of -----**
- 2) Block s is located ----- the modern periodic table**
- 3) Block p contains ----- group**
- 4) Noble gases fall into the category -----**
- 5) Block d is located in ----- the modern periodic table**
- 6) The first scientist to create a true periodic table -----**
- 7) Moseley arranged the elements in ascending order according to -----**
- 8) Number of elements in the modern periodic table -----**
- 9) The scientist discovered ----- that the nucleus contains positively charged protons**
- 10) The scientist added ----- the group of inert gases to the periodic table**

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