



Periodic Classification Of Elements

- **Introduction**
- **Need for classification**



Systematic arrangement
of clothes have been
done, so shopping
becomes easy





The most fundamental matter in Chemistry are "Elements".

The most fundamental matter in Chemistry are “Elements”.

Nonmetals –

Other nonmetals

Halogens

Noble gases

5 10.81 B Boron 2s ² 2p ¹	6 12.01 C Carbon 2s ² 2p ²	7 14.01 N Nitrogen 2s ² 2p ³	8 16.00 O Oxygen 2s ² 2p ⁴	9 19.00 F Fluorine 2s ² 2p ⁵	10 20.18 Ne Neon 2s ² 2p ⁶
13 26.98 Al Aluminum 3s ² 3p ¹	14 28.09 Si Silicon 3s ² 3p ²	15 30.97 P Phosphorus 3s ² 3p ³	16 32.07 S Sulfur 3s ² 3p ⁴	17 35.45 Cl Chlorine 3s ² 3p ⁵	18 39.95 Ar Argon 3s ² 3p ⁶
31 69.72 Ga Gallium 4s ² 4p ¹	32 72.61 Ge Germanium 4s ² 4p ²	33 74.92 As Arsenic 4s ² 4p ³	34 78.96 Se Selenium 4s ² 4p ⁴	35 79.90 Br Bromine 4s ² 4p ⁵	36 83.80 Kr Krypton 4s ² 4p ⁶
49 114.82 In Indium 5s ² 5p ¹	50 118.71 Sn Tin 5s ² 5p ²	51 121.76 Sb Antimony 5s ² 5p ³	52 127.60 Te Tellurium 5s ² 5p ⁴	53 126.90 I Iodine 5s ² 5p ⁵	54 131.29 Xe Xenon 5s ² 5p ⁶
81 204.38 Tl Thallium 6s ² 6p ¹	82 207.2 Pb Lead 6s ² 6p ²	83 208.98 Bi Bismuth 6s ² 6p ³	84 (209) Po Polonium 6s ² 6p ⁴	85 (210) At Astatine 6s ² 6p ⁵	86 (222) Rn Radon 6s ² 6p ⁶
Poor metals			Metalloids		– Metals

An element is a type of matter composed of only one kind of substance.

57 138.91 La Lanthanum 5d ¹ 6s ²	58 140.12 Ce Cerium 4f ¹ 5d ¹ 6s ²	59 140.91 Pr Praseodymium 4f ³ 6s ²	60 144.24 Nd Neodymium 4f ⁴ 6s ²	61 (145) Pm Promethium 4f ⁵ 6s ²	62 150.36 Sm Samarium 4f ⁶ 6s ²	63 151.96 Eu Europium 4f ⁷ 6s ²	64 157.25 Gd Gadolinium 4f ⁷ 5d ¹ 6s ²	65 158.93 Tb Terbium 4f ⁹ 6s ²	66 162.50 Dy Dysprosium 4f ¹⁰ 6s ²	67 164.93 Ho Holmium 4f ¹¹ 6s ²	68 167.26 Er Erbium 4f ¹² 6s ²	69 168.93 Tm Thulium 4f ¹³ 6s ²	70 173.04 Yb Ytterbium 4f ¹⁴ 6s ²	71 174.97 Lu Lutetium 5d ¹ 6s ²			Lanthanides	
89 (227) Ac Actinium 6d ¹ 7s ²	90 232.04 Th Thorium 6d ² 7s ²	91 231.04 Pa Protactinium 5f ² 6d ¹ 7s ²	92 238.03 U Uranium 5f ³ 6d ¹ 7s ²	93 (237) Np Neptunium 5f ⁴ 6d ¹ 7s ²	94 (244) Pu Plutonium 5f ⁶ 7s ²	95 (243) Am Americium 5f ⁷ 7s ²	96 (247) Cm Curium 5f ⁸ 6d ¹ 7s ²	97 (247) Bk Berkelium 5f ⁹ 7s ²	98 (251) Cf Californium 5f ¹⁰ 7s ²	99 (252) Es Einsteinium 5f ¹¹ 7s ²	100 (257) Fm Fermium 5f ¹² 7s ²	101 (258) Md Mendelevium 5f ¹³ 7s ²	102 (259) No Nobelium 5f ¹⁴ 7s ²	103 (262) Lr Lawrencium 6d ¹ 7s ²			Actinides	

Initially scientists discovered elements like gold, silver, carbon(coal). They classified them into metals and non-metals.

Some elements showed properties of both metals and non-metals which were known as Metalloids

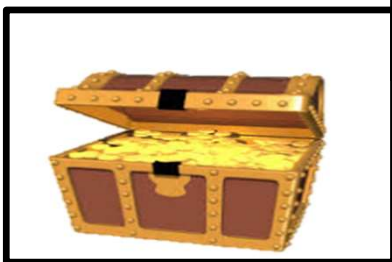
Metals

Non-metals

COPPER, SILVER, IRON



GOLD



CARBON(COAL)



SULPHUR



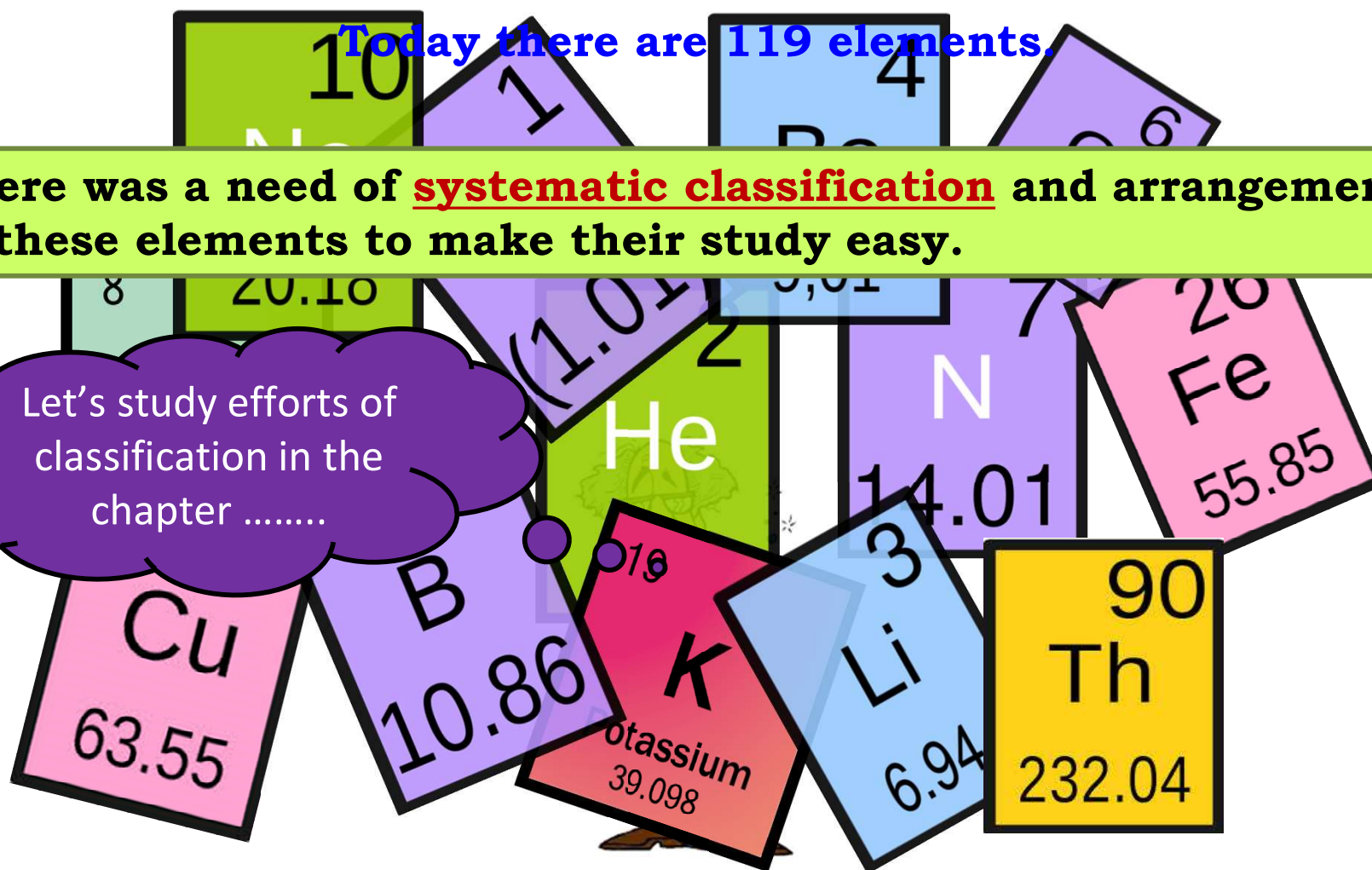
SILICON



Today there are 119 elements.

There was a need of **systematic classification** and arrangement of these elements to make their study easy.

Let's study efforts of classification in the chapter

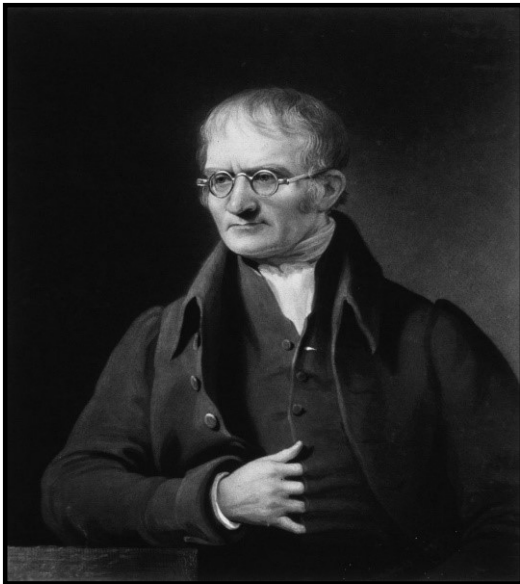




Periodic Classification Of Elements

- **Dobereiner's law of triads**
- **Limitations of Dobereiner's law of triad**

John Dalton



English Chemist

He proposed the atomic theory ted
from the year 1808
fundamental characteristic of every atom

Johann Wolfgang Dobereiner



German Chemist

In earlier attempts, the elements were classified on the basis of their properties. All the elements having similar properties were put in one group called a family.

Tried to classify the elements for the first time, based on the atomic theory given by Dalton.

Dobereiner's Law Of Triads

- ❖ He arranged chemically similar elements
- ❖ In the increasing order of their atomic masses
- ❖ In a group of three
- ❖ Known as Dobereiner's Triads

E.g.

Elements	Lithium	Sodium	Potassium
Symbols	Li	Na	K
Atomic masses	6.9	23.0	39.0

In a Triad

The mean was approximately equal to the atomic mass of middle element

For example:

- All these elements are metals
- All of them react with water to form alkalis and hydrogen gas
- All of them have a valency of 1

Elements	Calcium	Strontium	Barium
-----------------	---------	-----------	--------

Symbols	Ca	Sr	Ba
----------------	----	----	----

For example:

- i) All these elements are metals
- ii) The oxides of all them are alkaline in nature
- iii) All these elements have a valency of 2

N P As
Are chemically similar
elements
of the triad.

mean of atomic masses of
first and the last element
of the triad.

Elements	Nitrogen	Phosphorus	Arsenic
-----------------	----------	------------	---------

Symbols	N	P	As
----------------	---	---	----

Atomic masses	14.0	31.0	74.9
----------------------	------	------	------

$$\frac{14.0 + 74.9}{2} = \frac{88.9}{2} = 44.45$$

Limitations of Dobereiners Law Of Triads

Dobereiner could identify only few triads from the elements known at that time, other triads did not obey **Dobereiner's rule.** Hence, the system of triads was not useful.

FAILED





Periodic Classification Of Elements

- **Newlands' law of octaves**
- **Features of newlands' law of octaves**

John Newlands



English Scientist

After the failure of Dobereiner's triad, the next attempt to classify elements was done in the year 1864.

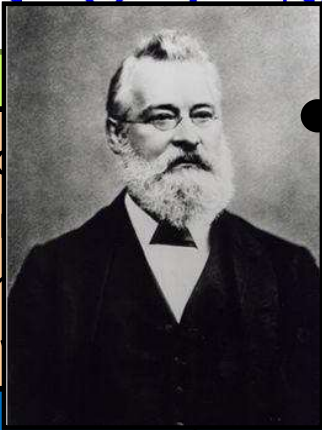
By this time, 56 elements were discovered. Newlands arranged all these elements in an increasing order of their atomic masses.

Elements	Symbols	Elements	Symbols
Hydrogen	H	Aluminium	Al
Lithium	Li	Silicon	Si
Beryllium	Be	Phosphorous	P
Boron	B	Sulphur	S
Carbon	C	Chlorine	Cl
Nitrogen	N	Potassium	K
Oxygen	O	Calcium	Ca
Fluorine	F		
Sodium	Na		
Magnesium	Mg		

Newlands' Law Of Octaves

H Li Be B C N O F Na Mg Al Si P S Cl K Ca

When the elements are arranged in order of increasing atomic masses, the first eight elements resemble the notes of an octave on a piano keyboard. Newlands placed the elements in groups of eight, called octaves.



Sa (do)	Re (re)	Mi (mi)	Fa (fa)	So (so)	La (la)	Ni (ti)

Features Of Newlands' Table

- ❖ Newlands knew 56 elements.
- ❖ After Calcium every eighth element did not possess properties similar to that of first.

- ❖ Two elements with different properties placed in the same box.
- ❖ Iron element (Fe) which resembles cobalt and nickel elements in properties, was placed far away from these elements.

- ❖ This table did not include inert gases because they were not yet discovered.

He didn't explain why 2 elements were kept together

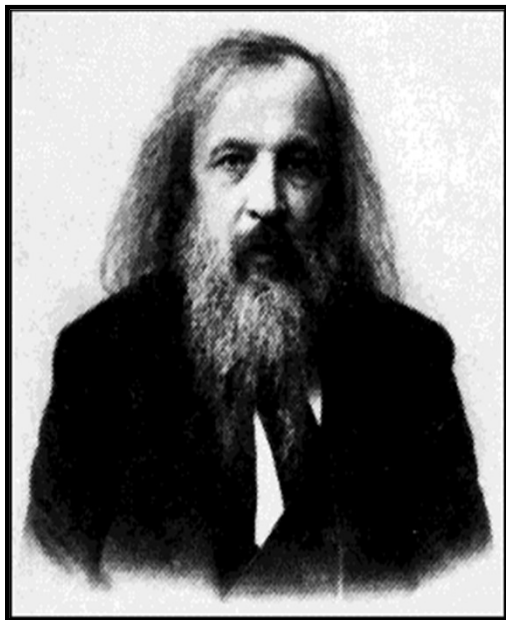
Sa	Re	Ga	Ma	Pa	Da	Ni
Sa (do)	Re (re)	Ga (mi)	Ma (fa)	Pa (so)	Da (la)	Ni (ti)
H	Li	Be	B	C	N	O
F	Na			P	S	
Cl	K			Mn	Fe	Fe
Co & Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce & La	Zr		



Periodic Classification Of Elements

- **Mendeleev's periodic classification**
- **Features of periodic classification**

Dimitri Ivanovitch Mendeleev



Russian Chemist

After the failure of Newlands' law of octaves, the next attempt to classify elements was done in the year 1869

Called as father of classification. He also arranged elements according to their atomic masses

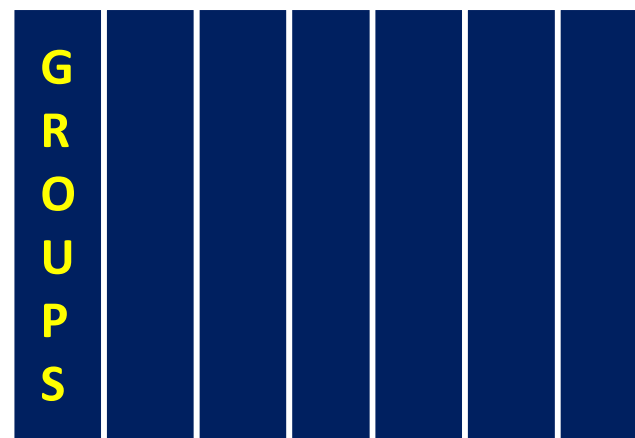
- ❖ Most important contributor in classification of elements.
- ❖ Mendeleev knew 63 elements.
- ❖ He classified elements on the basis of **Atomic masses**
- ❖ Ar Since formula of these oxides chemical properties.
- ❖ M is same, Mendeleev placed all of the oxides and hydrides formed by
th of them in the same group property of elements for their classification
in the of a periodic table.

H				
Li	Be	B		
Na	Mg	Al		
K	Ca			
Fe	Co	Ni	Cu	

Formula for beryllium oxide is **BeO**
 Formula for magnesium oxide is **MgO**
 Formula for calcium oxide is **CaO**

Silicon which was similar to it. Hence he left vacant space

- ❖ On the basis of this Mendeleev formulated a **PERIODIC LAW**.
 - ❖ The physical and chemical properties of elements are a **Periodic** function of their **“Atomic masses”**
 - ❖ The tabulation of elements based on the periodic law is called the **Periodic Table**
 - ❖ Horizontal rows are called **PERIODS**
 - ❖ Vertical columns are called **GROUPS**
- There are 8 groups numbered from I to VIII, groups I to VII are further divided into A & B sub groups
- There are 7 periods numbered from 1 to 7.



Main Features Of Mendeleev's Periodic Table

- ❖ The horizontal rows in the periodic table are called periods. There are seven periods. These are numbered from 1 to 7
- ❖ Properties of elements in a particular period show **REGULAR GRADATION** from left to right.

- ❖ Vertical columns in the periodic table are called groups. As we go from left to right, you can see a slow variation in the properties of elements from metals to nonmetals.

Metals

Metalloid

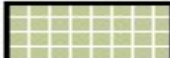


Non metals



Periodic Classification Of Elements

- **Merits of Mendeleev's periodic table**
- **Demerits Mendeleev's periodic table**

Merits Of Mendeleev's Periodic Table

	Dobereiner's triads				Known to Mendeleev				Unknown to Mendeleev		
	H 1.01										
He 4.00	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	
	Cu 63.5	Zn 65.4	Ga 69.7	Ge 72.6	As 74.9	Se 79.0	Br 79.9				
Kr 83.8	Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9	Tc (99)	Ru 101	Rh 103	Pd 106	
	Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128	I 127				
Xe 131	Ce 133	Ba 137	La 139	Hf 179	Ta 181	W 184	Re 180	Os 194	Ir 192	Pt 195	
	Au 197	Hg 201	Tl 204	Pb 207	Bi 209	Po (210)	At (210)				
Rn (222)	Fr (223)	Ra (226)	Ac (227)	Th 232	Pa (231)	U 238					
Eka-silicon.				Germanium							
				232	238						

Comparison Of Properties Of Eka-Aluminium And Gallium

	Eka-aluminium	Gallium
Atomic weight	About 68	69.72
Density of solid	6.0g/cm ³	5.9g/cm ³
Melting point	Low	29.78°C
Valency	3	3
Method of discovery	Low – approximate room temperature	Spectroscopically
Oxides	Ea ₂ O ₃	Ga ₂ O ₃

This table confirms that predicted elements & discovered elements are similar .

Demerits Of Mendeleev's Periodic Table

[illegible]



Periodic Classification Of Elements

- **Modern periodic table**
- **Layout of modern periodic table**

Henry Moseley



ENGLISH
PHYSICIST

He studied the demerits of previous attempts of classification and discovered that Atomic number(Z) is the most fundamental property of an element and not its atomic mass.

No. of protons
or electrons

Moseley found that
electrons take part in
a chemical reaction
and not protons.

- ❖ **Discovery of atomic number changed the whole perspective about elements and their properties.**
- ❖ **Accordingly, Mendeleev's periodic law was modified into 'Modern Periodic Law'.**

M	MODERN PERIODIC LAW	N
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- ❖ **The chemical and physical properties of elements are a Periodic function of their "Atomic Numbers".**
- ❖ **The periodic table based on modern periodic law is called the Modern Periodic Table.**

Layout Of Modern Periodic Table

Long form of periodic table

Horizontal rows in the periodic table are called Periods.

Vertical columns in the periodic table are called Groups.

In order to place all the known elements Moseley added many more groups hence it is called long form of periodic table

G																			
R																			
O																			
U																			
P																			
S																			

In modern periodic table there are 18 groups, 7 periods and 2 additional series at the bottom of the periodic table



Periodic Classification Of Elements

- **Modern periodic table**

Modern Periodic Table

The diagram illustrates the periodic table with the following callouts and labels:

- Longest Period (32):** Points to the 6th period, which contains 32 elements (Cs to Rn).
- Incomplete Period:** Points to the 7th period, which is incomplete as it contains elements up to Ra.
- Long Period (18):** Points to the 4th period, which contains 18 elements (K to Kr).
- Lanthanides (14):** A series of 14 elements (Ce to Lu) inserted below the 6th period.
- Actinides (14):** A series of 14 elements (Th to Lr) inserted below the 7th period.

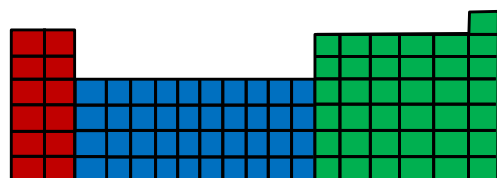
Additional text in the diagram includes:

- "Let's Now fill up group..."
- "Since 7th period is not complete it is called..."
- "Since 6th period contains 18 + 14 lanthanides which is equal to 32 elements, it is called..."
- "14 elements past Actinium are..."
- "...from atomic number 58 to 71..."



Periodic Classification Of Elements

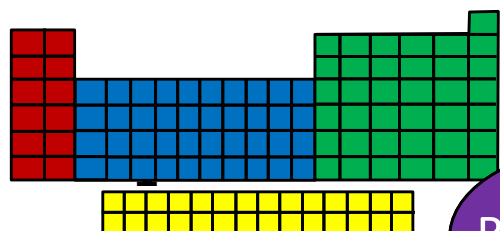
- **Classification of elements in groups**
- **Characteristics of group I and II**



Group 1 & 2

1	1 H IA															
2	3 Li IA	4 Be IIA														
3	11 Na IA	12 Mg IIA														
4	(2,8,1)	(2,8,2)														
5																
6																
7																

- ❖ Lets take electronic configuration of Na & Mg
- ❖ All the elements in group 1 and 2 will have either 1 or 2 electrons in the outermost orbit
- ❖ All of them in order to become stable donate electrons. Therefore all are metals except hydrogen
- ❖ Since, only outermost shell is incomplete they are called as 'Normal elements'.



Groups 13 to 18

Right hand side of zig-zag line are all non-metals and on left hand side all metals. And on the border all metalloids are present.

- ❖ All the elements in this block have 3 to 8 electrons in their outer shell.
- ❖ Zig-zag line in this block divides entire periodic table into two parts

- ❖ This block contains metals, non-metals, and metalloids.

Chemically inactive

- ❖ as well as noble gases.

- ❖ This block contains normal as well as inert elements.

					zero 18
					2 He
IVA 14	VA 15	VIA 16	VIIA 17		
(2,3) B	(2,4) C	(2,5) N	(2,6) O	(2,7) F	(2,8) Ne
Al	Si				18 Ar
Ge	As				
	Sb	Te			
		Po			

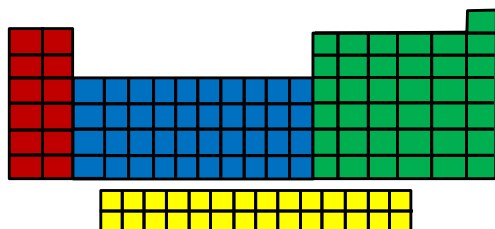
METALS

NON-METALS



Periodic Classification Of Elements

- **Transition elements**
- **Inner transition elements**



Groups 3 to 12

IIIB	IVB	VB	VIB	VII B	←VIII→	IB	IIB
3	4	5	6	7	8	9	10
			Fe(2, 8, 14, 2)				

- ❖ **Group 3 to 12 are known as heavy metals.**
- ❖ **These elements have last two shells incomplete**
- ❖ **All these elements are metals since they are on the left hand side of the zig-zag line**
- ❖ **They are known as transition elements**



Lanthanide & Actinide Series

- ❖ **Elements present at the bottom of the periodic table is called as lanthanides and actinides series.**
- ❖ **They have their last 3 shells incompletely filled. They are metals.**
- ❖ **They are also known as inner transition elements.**

[illegible]

Similarities Between Hydrogen And Alkali Metals

	1A 1A													13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	VIIIA 8A
1	1 H 1.008																		2 He 4.003
2	3 Li 6.941	4 Be 9.0												5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
3	11 Na 22.99	12 Mg 24.31	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8 ----- VIII ----- 8	9 ----- ----- -----	10 ----- ----- -----	11 IB 1B	12 IIB 2B	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95	
4	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.47	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80	
5	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3	
6	55 Cs 132.9	56 Ba 137.3	57 La* 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 190.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.5	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (210)	85 At (210)	86 Rn (222)	
7	87 Fr (223)	88 Ra (226)	89 Ac~ (227)	104 Rf (257)	105 Db (260)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 --- ()	111 --- ()	112 --- ()		114 --- ()		116 --- ()		118 --- ()	

Group I A elements are called as alkali metals

Group I A elements
are called as alkali
metals

less than the nearest

ents

5	6	7	8	9	10
B	C	N	O	F	Ne
10.81	12.01	14.01	16.00	19.00	20.18
13	14	15	16	17	18
Al	Si	P	S	Cl	Ar
26.98	28.09	30.97	32.07	35.45	39.95
31	32	33	34	35	36
Ga	Ge	As	Se	Br	Kr
69.72	72.64	74.92	78.96	79.90	83.80
49	50	51	52	53	54
In	Sn	Sb	Te	I	Xe
114.8	118.7	121.8	127.6	126.9	131.3
81	82	83	84	85	86
Tl	Pb	Bi	Po	At	Rn
204.4	207.2	209.0	(210)	(210)	(222)
114	116	118			
---	---	---			
()	()	()			



Periodic Classification Of Elements

- **Merits of Modern periodic table**
- **Periodic properties**

Merits Of Modern Periodic Table

All isotopes of the same elements occupy the same position in the modern periodic table .

Since the elements are arranged according to their atomic number, the anomalies regarding certain pairs of elements in Mendeleev's periodic table disappears. E.g. Atomic number of cobalt and nickel are 27 and 28 respectively. Therefore cobalt will come first due to its atomic number and then nickel although its atomic mass is greater.

F 19.0			
Cl 35.5			
Mn 54.9	Fe 55.9	Co 58.9	Ni 58.7
Br 79.9			
Tc (99)	Ru 101	Rh 101	Pd 106
At (210)			

**higher atomic mass
placed before lower
atomic mass.**

classified according to their electronic configuration
blocks.

The image displays a periodic table with several callouts highlighting specific groups of elements:

- Alkali metals:** Group 1 elements (H, Li, Na, K, Rb, Cs, Fr).
- Alkaline earth metals:** Group 2 elements (Be, Mg, Ca, Sr, Ba, Ra).
- Hydrogen is an exception:** A callout pointing to Hydrogen (H).
- Halogens:** Group 17 elements (F, Cl, Br, I, At).
- Inert gas:** Group 18 elements (He, Ne, Ar, Kr, Xe, Rn).
- Group VIIA elements are called halogens:** A callout pointing to the Halogen group.
- Zero Group elements are called inert gases:** A callout pointing to the Inert Gas group.
- They are sea salt generators:** A callout pointing to the Alkali metals group.
- They are chemically inactive:** A callout pointing to the Inert Gas group.

The periodic table also includes the Lanthanides (14 elements) and Actinides (14 elements) at the bottom.

Alkaline

Halogens

Zero Group

They are sea salt generators

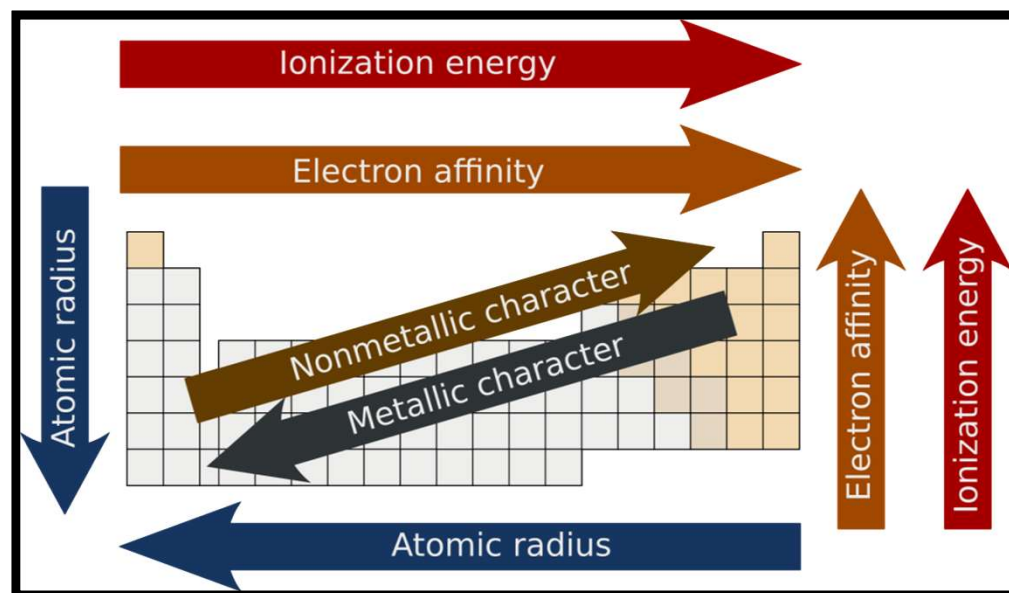
They are chemically inactive

Lanthanides (14)

Actinides (14)

Characteristics Of Periods And Groups

The properties which show gradual variation in a group and in a period and they repeat themselves after a certain interval of atomic number are called periodic properties.



1. **Valency**
2. **Atomic size**
3. **Metallic & non-metallic properties**



Periodic Classification Of Elements

- **Valence electrons**
- **Board Questions**

Valence Electrons (Or Outermost Electrons)

On moving from left to right in a period , the number of valence electrons in elements increases from 1 to 8

Elements of third period	11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
Electronic configurations	2,8,1	2,8,2	2,8,3	2,8,4	2,8,5	2,8,6	2,8,7	2,8,8
Number of Valence electrons	1	2	3	4	5	6	7	8

The first element in every period has 1 Valence electron and the last element in every period has 8 valence electron (except in the first period where last element helium has only 2 valence electrons)

Valence Electrons (Or Outermost Electrons)

All the elements of a group of the periodic table have the same Number of valence electrons.

Group 1	Electronic configuration	No. of valence electrons
Li	2, 1	1
Na	2, 8, 1	1
K	2, 8, 8, 1	1

Since all the elements in a group have similar electronic configuration having the same number of valence electrons they show similar chemical properties

On moving down in a particular group of the periodic table, the number of valence electrons in the elements remains the same.

How to find the group number of an element in the periodic table from the number of valence electrons in its atom.

- i) The group number of elements having 1 to 10 valence electrons is equal to the number of valence electrons.**

If number of valence electrons is 1, then group number is 1.

If number of valence electrons is 2, then group number is 2.

There is, however, one exception to this rule. The noble gas 'helium' has 2 valence electrons in K shell but its group number is 18.

- ii) The group number of elements having 11 to 18 valence electrons is equal to the number of valence electrons plus 10.**

If number of valence electrons is 3, then group number is $3+10=13$

If number of valence electrons is 4, then group number is $4+10=14$

If number of valence electrons is 7, then group number is $7+10=17$

The electronic configuration of an element X is: K L M

2, 8, 6



5 mark
Questions

What is the group number of element X in the periodic table?

Ans: From the above given electronic configuration we find that

element X has 6 valence electrons in the outermost shell so
i) What is the group number of element X in the periodic table?
the group number of element X in periodic table is $6+10=16$.

ii) What is the period number of element X in the periodic table?

ii) What is the period number of element X in the periodic table?

iii) What is the number of valence electrons in an atom of X?

Ans: Element X has 3 electron shells (K,L and M) in its atom, so the

iv) What is the valency of X?
period number of X is 3. That is, X belongs to 3rd period of the
periodic table.

v) Is it a metal or a non metal?

iii) What is the number of valence electrons in an atom of X?

Ans: Elements X has 6 valence electrons.

The electronic configuration of an element X is: K L M
2, 8, 6

iv) What is the valency of X?

5 mark
question

Ans: Element X has 6 valence electrons so it needs 2 more electrons to complete its octet 8 electrons in valence shell and become stable. Thus, the valency of element X is 2.

v) Is it a metal or a non metal?

Ans: The elements of group 16 are non-metals. So, X is a non-metal.

An element X is in group 13 of the periodic table. What is the formula of its oxide?

Solution:

5 mark
Questions

**In order
should 1
the vale
oxygen**

**Element
X
O**

We know that the element aluminium belongs to group 13 of the periodic table and has a valency of 3. So, the element X of the above given problem could be aluminium, Al and the oxide X_2O_3 could be actually aluminium oxide, Al_2O_3 .

**ne oxide of element X, we
f group 13 elements is 3. So,
dy know that the valency of
onclusions:**

Since the valency of element X is 3 and that of O is 2, two atoms of X will combine with three atoms of O to form an oxide X_2O_3 . Thus, the formula of oxide of element X is X_2O_3 .



Periodic Classification Of Elements

- **Valency**

Valency

The valency of an element is equal to the number of valence electrons.

Valency increases from 1 to 4 and then decreases from 4 to 0.

All the elements in a group have the same valency.

Therefore,

1 (K)	1 H (1)							
2 (K,L)								
3 (K,L,M)	11 Na (2,8,1)	12 Mg (2,8,2)	13 Al (2,8,3)	14 Si (2,8,4)	15 P (2,8,5)	16 S (2,8,6)	17 Cl (2,8,7)	18 Ar (2,8,8)
Valency	1	2	3	4	3	2	1	0



Give, T
Share el

Na, Mg & Al contain 1, 2 & 3 electrons respectively in their outermost shell, to become stable it is easier for them to donate electrons. So their valency is 1, 2 & 3 respectively.

C & Si contain 4 electrons in their outermost shell, to become stable it is easier for them to share electrons. So their valency is 4.

It is easier for them to accept electrons. So their valency is 3, 2, 1 & 0 respectively.

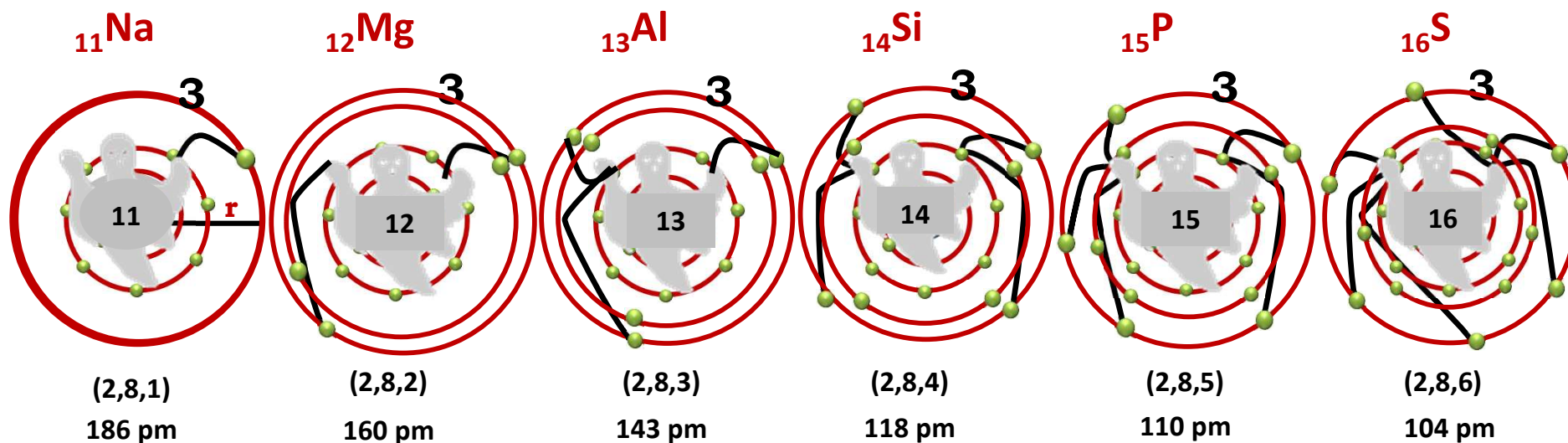


Periodic Classification Of Elements

- **Atomic size in period and group**

Atomic Size Across The Period

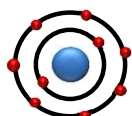
- ❖ The term atomic size refers to the radius of an atom.
- ❖ Atomic radius is the distance between the centre of atom & outermost shell.



As we go from left to right in a period, the nuclear charge increases, thus the pull between the electrons and protons increases. Therefore, the atomic size decreases as we go from left to right.

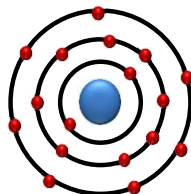
Atomic Radius Down The Group

F
r = 64pm



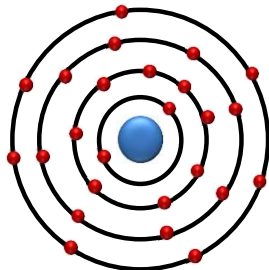
2

Cl
r = 99pm



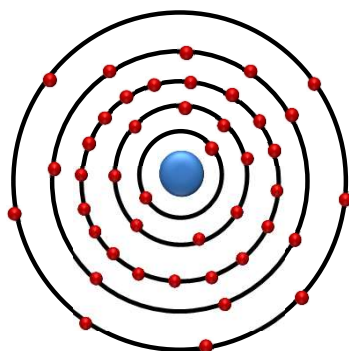
3

Br
r = 114pm



4

I
r = 133pm



5

Atomic radius increases in a group from top to bottom as new shells are added bringing outermost electrons farther from the nucleus



Periodic Classification Of Elements

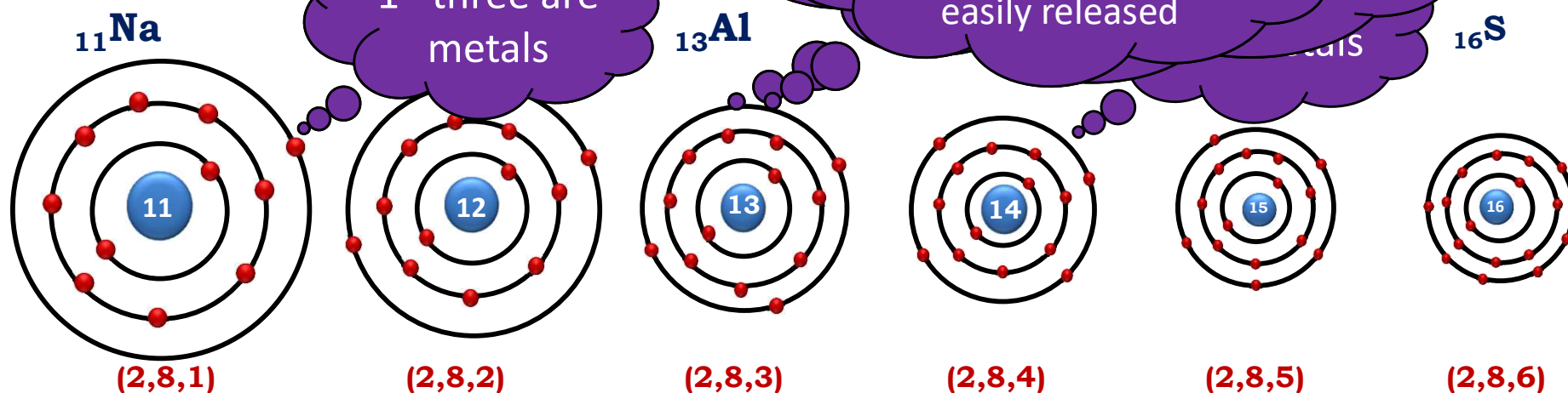
- **Metallic & Non-metallic character**

Metallic & Non-Metallic Character

Metals have 1, 2 or 3 electrons in their outermost orbit. In order to become stable, metals donate electrons & form positive ions (Na^+ , Mg^{+2}). Therefore metals are said to be **ELECTROPOSITIVE**.

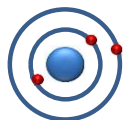
Non-metals have 4 – 7 electrons in their outermost orbit. In order to become stable, non-metals share electrons & form negative ions (S^{2-} , P^{3-}). Therefore non-metals are said to be **ELECTRONEGATIVE**.

This is because atomic size decreases. Therefore, the electrons are not easily released

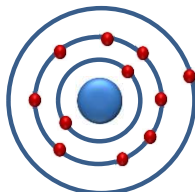


Metallic & Non-Metallic Character Down The Groups

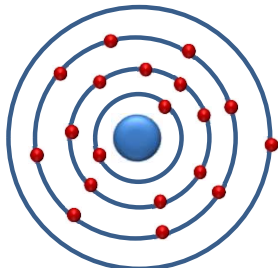
Lithium



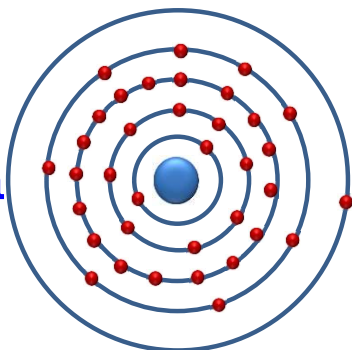
Sodium



Potassium



Rubidium



In a group, metallic character increases and non-metallic character decreases from top to bottom. This is because atomic size increases and valence electrons can be easily removed.

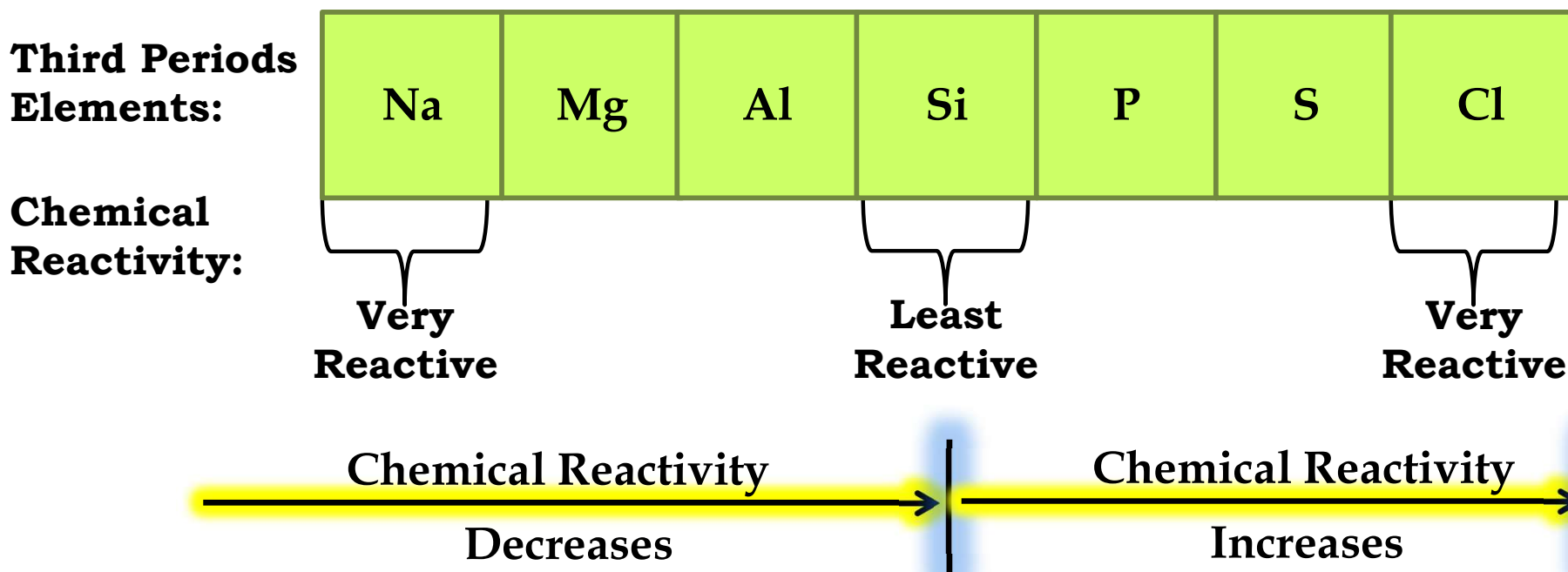


Periodic Classification Of Elements

- **Chemical Reactivity**
- **Nature of oxides**

Chemical Reactivity

On moving from left to right in a period, the chemical reactivity of elements first decreases and then increases.



Chemical Reactivity

The chemical reactivity of metals increases on going down in a Group of the periodic table.

As we go down in a group of metals, the tendency of their atoms to lose electrons increases, and hence their chemical reactivity also increases.

Lithium	Li	Least reactive
Sodium	Na	Chemical reactivity of metals increases on going down in a group
Potassium	K	
Rubidium	Rb	
Cesium	Cs	

The tendency of their atoms to gain electrons decreases due to which their reactivity also decreases

	Group 17	
Fluorine	F	Most reactive
Chlorine	Cl	Chemical reactivity of non-metals decreases on going down in a group
Bromine	Br	
Iodine	I	
		Least reactive

Nature Of Oxides

On going down in a group of the periodic table there is no change in the nature of oxides of elements.

Lithium	Li
Sodium	Na
Potassium	K
Rubidium	Rb
Cesium	Cs
Francium	Fr

All the elements of group 1 form basic oxides.

All the elements of group 17 are non-metals and non-metals tend to form acidic oxide.

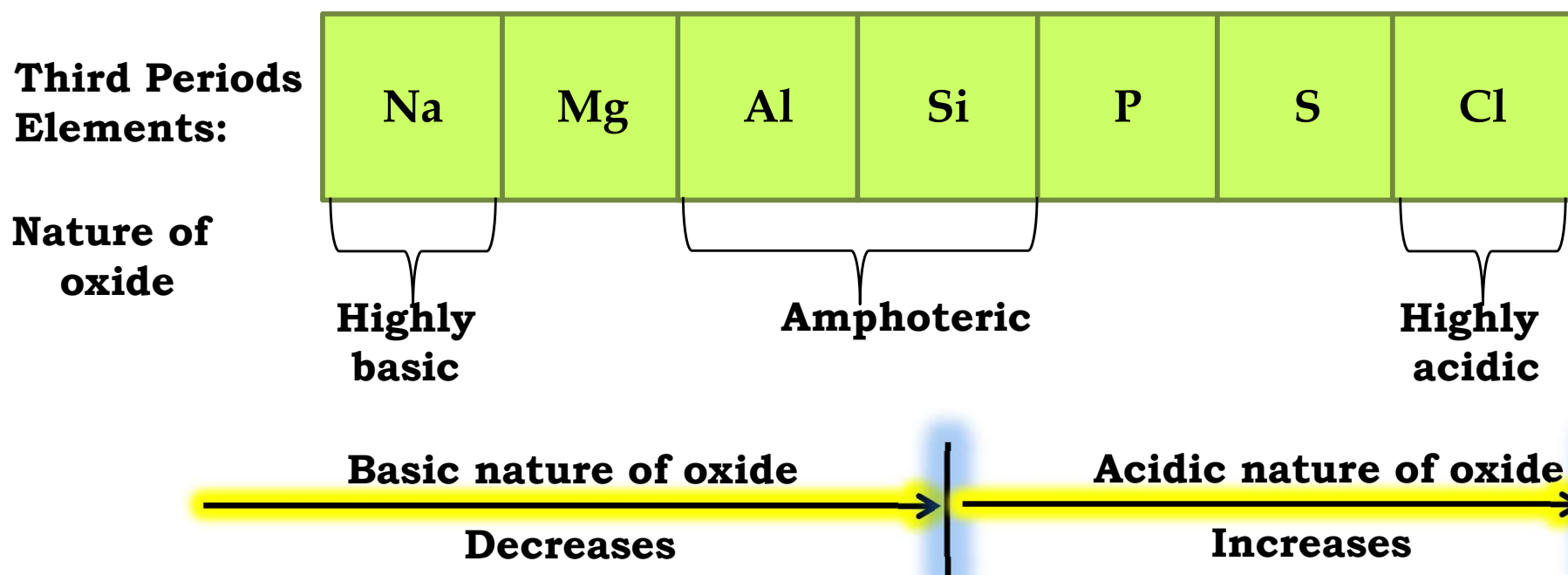
Group
17

Fluorine	F
Chlorine	Cl
Bromine	Br
Iodine	I

All the elements of group 17 form acidic oxides.

Nature Of Oxides

On moving from left to right in a period, the basic nature of oxide decreases and the acidic nature of oxide increases.





Periodic Classification Of Elements

- **Electron Affinity**
- **Ionisation Potential**

Trends in Electron Affinity Electronegativity

From Left To Right

Elements	E.A. [eV]	Trends in electron affinity down a group		ELECTRON AFFINITY
F (2,7)	-3.60	<ul style="list-style-type: none">• ATOMIC RADII Increases	<ul style="list-style-type: none">• ELECTRON AFFINITY Decreases	<div>↓</div> <div>DECREASES</div> <div>DOWN A GROUP</div>
Cl (2,8,7)	-3.80	[No. of shells increases]		
Br (2,8,18,7)	-3.50	<ul style="list-style-type: none">• NUCLEAR CHARGE Increases	<ul style="list-style-type: none">• ELECTRON AFFINITY Should increase	
I (2,8,18,18,7)	-3.20	<p>— Increases in atomic radii dominates over Increases in nuclear charge</p> <p>∴ Overall electron affinity - Decreases</p>		

Trends in Ionisation Potential in the Periodic Table

From Left To Right

Atomic Size- Increases

a loosely bound electron from the

Elements	I.P. [eV]	Trends in ionisation potential down a group		IONISATION POTENTIAL
Li (2,1)	5.4	<ul style="list-style-type: none">ATOMIC RADII Increases [No. of shells increases]	IONISATION POTENTIAL Decreases	<div>↓</div> <div>DECREASES DOWN A GROUP</div>
Na (2,8,1)	5.1		IONISATION POTENTIAL Should increase	
K (2,8,8,1)	4.3	<ul style="list-style-type: none">NUCLEAR CHARGE Increases		
Rb (2,8,18,8,1)	4.2	— Increases in atomic radii dominates over increases in nuclear charge		
Cs (2,8,18,18,8,1)	3.9	∴ Overall ionisation potential - Decreases		

Thank You