Chapter 5

Periodic Classification of elements

Q. What is Dobereiner's contribution in classification of elements ?

Ans. According to Döbereiner, when three elements were arranged in the increasing order of atomic masses, the atomic mass of middle element was roughly equal to the average atomic mass of other two elements.

example – Li – 7 u
Na – 23 u
K – 39 u

$$\frac{7+39}{2} = \frac{46}{2} = 23$$

Table 5.2
Döbereiner's triads

Li	Ca	Cl
Na	Sr	Br
K	Ba	I

Q. What is the drawback / limitation of Dobereiner's triads ?

Ans. All the elements could not be classified into triads discovered at that time. He could identify only 3 triads known at that time.

Table 5.2
Döbereiner's triads

Li	Ca	Cl
Na	Sr	Br
K	Ba	I

Q. Define Newland's law of Octaves.

Ans. the properties of every eighth element is similar to that of the first element.

Table 5.3 Newlands' Octaves

Notes of music:	sa (do)	re (re)	ga (mi)	ma (fa)	pa (so)	da (la)	ni (ti)
	H	Li	Be	B	C	N	O
	F	Na	Mg	Al	Si	P	S
	Cl	K	Ca	Cr	Ti	Mn	Fe
	Co and Ni	Cu	Zn	Y	In	As	Se
	Br	Rb	Sr	Ce and La	Zr	—	—

Q. What is Newland's contribution in classification of elements ?

Ans. According to this law, when the elements are arranged in increasing order of atomic masses, every eight element have properties similar to that of first.

Table 5.3 Newlands' Octaves

Notes of music:	sa (do)	re (re)	ga (mi)	ma (fa)	pa (so)	da (la)	ni (ti)
	H	Li	Be	B	C	N	O
	F	Na	Mg	Al	Si	P	S
	Cl	K	Ca	Cr	Ti	Mn	Fe
	Co and Ni	Cu	Zn	Y	In	As	Se
	Br	Rb	Sr	Ce and La	Zr	—	—

Q. What is drawbacks / limitations of Newland 's octaves ?

Ans.

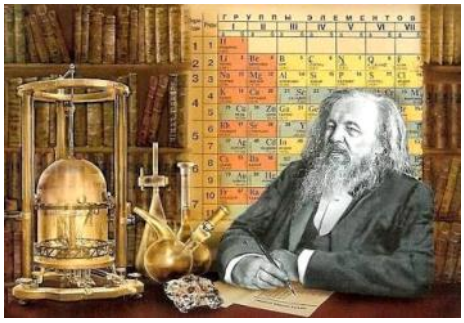
1. Law of octaves was applicable upto calcium.
2. It was assumed by Newland that only 56 elements existed in nature, and no more elements would be discovered in future.
3. Newland placed two elements in the same slot. example: cobalt & nickel
4. Iron which resembles cobalt & nickel in properties has been placed far away from these elements.

Table 5.3 Newlands' Octaves

Notes of music:	sa (do)	re (re)	ga (mi)	ma (fa)	pa (so)	da (la)	ni (ti)
	H	Li	Be	B	C	N	O
	F	Na	Mg	Al	Si	P	S
	Cl	K	Ca	Cr	Ti	Mn	Fe
	Co and Ni	Cu	Zn	Y	In	As	Se
	Br	Rb	Sr	Ce and La	Zr	—	—

Mendeleev 's Periodic Table

Group	I	II	III	IV	V	VI	VII	VIII
Oxide Hydride	R_2O RH	RO RH_2	R_2O_3 RH_3	RO_2 RH_4	R_2O_5 RH_3	RO_3 RH_2	R_2O_7 RH	RO_4
Periods ↓	A B	A B	A B	A B	A B	A B	A B	Transition series
1	H 1.008							
2	Li 6.939	Be 9.012	B 10.81	C 12.011	N 14.007	O 15.999	F 18.998	
3	Na 22.99	Mg 24.31	Al 29.98	Si 28.09	P 30.974	S 32.06	Cl 35.453	
4 First series: Second series:	K 39.102 Cu 63.54	Ca 40.08 Zn 65.37	Sc 44.96 Ga 69.72	Ti 47.90 Ge 72.59	V 50.94 As 74.92	Cr 50.20 Se 78.96	Mn 54.94 Br 79.909	Fe 55.85 Co 58.93 Ni 58.71
5 First series: Second series:	Rb 85.47 Ag 107.87	Sr 87.62 Cd 112.40	Y 88.91 In 114.82	Zr 91.22 Sn 118.69	Nb 92.91 Sb 121.75	Mo 95.94 Te 127.60	Tc 99 I 126.90	Ru 101.07 Rh 102.91 Pd 106.4
6 First series: Second series:	Cs 132.90 Au 196.97	Ba 137.34 Hg 200.59	La 138.91 Tl 204.37	Hf 178.49 Pb 207.19	Ta 180.95 Bi 208.98	W 183.85		Os 190.2 Ir 192.2 Pt 195.09



Dmitri Ivanovich Mendeleev

Q. What are the two factors on which mendeleev 's periodic table was based ?

Ans. 1. Increasing atomic masses of elements.

2. Grouping together of elements having similar properties.

Q. What are the merits / achievements of Mendeleev 's periodic table ?

Ans. 1. Mendeleev predicted the existence of some elements that had not been discovered at that time.

He left some gaps for the undiscovered elements like scandium (Sc) gallium (Ga) and germanium (Ge) and when they discovered they were placed in those gaps without disturbing the other elements.

2. Mendeleev predicted the properties of several elements on the basis of their position in the table.

The properties of Eka-Boron predicted by Mendeleev were similar to Scandium. Similarly, Eka-aluminium properties were similar to Gallium and Eka-silicon properties were similar to Germanium.

Property	*Eka*-aluminium	Gallium
Atomic Mass	68	69.7
Formula of Oxide	E_2O_3	Ga_2O_3
Formula of Chloride	ECl_3	$GaCl_3$

Eka-boron → Scandium

Eka-aluminium → Gallium

Eka-silicon → Germanium

3. Noble gases were disovered later, they were placed in Mendeleev's periodic table in new group without disturbing the existing elements.

Q. Why Mendeleev selected hydrogen and oxygen for the formulas in his table ?

Ans. Because hydrogen and oxygen are very reactive and form compounds with most of the elements.

Group	I	II	III	IV	V	VI	VII	VIII
Oxide Hydride	R_2O RH	RO RH_2	R_2O_3 RH_3	RO_2 RH_4	R_2O_5 RH_3	RO_3 RH_2	R_2O_7 RH	RO_4
Periods ↓	A B	A B	A B	A B	A B	A B	A B	Transition series
1	H 1.008							
2	Li 6.939	Be 9.012	B 10.81	C 12.011	N 14.007	O 15.999	F 18.998	
3	Na 22.99	Mg 24.31	Al 29.98	Si 28.09	P 30.974	S 32.06	Cl 35.453	

Group	I	II	III	IV	V	VI	VII	VIII
Oxide Hydride	R_2O RH	RO RH_2	R_2O_3 RH_3	RO_2 RH_4	R_2O_5 RH_3	RO_3 RH_2	R_2O_7 RH	RO_4
Periods ↓	A B	A B	A B	A B	A B	A B	A B	Transition series
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Q. What is periodicity of elements ?

Ans. When the elements are arranged in increasing order of atomic masses. Elements with similar properties are repeated after certain regular intervals.

this repeatation of properties of elements after regular intervals is called periodicity of elements.

Q. What were the limitations of Mendeleev 's periodic table ?

Ans**1. He could not assign correct position of hydrogen in his table :-** Hydrogen has been placed in group - 1 with alkali metals because like alkali metals,

hydrogen also combines with halogens and oxides to form compounds having similar formulas. But hydrogen also resembles halogens as it also form diatomic molecule like halogens.

Alkali metals ↑ Halogens ↑

Group	I	II	III	IV	V	VI	VII	VIII
Oxide Hydride	R_2O RH	RO RH_2	R_2O_3 RH_3	RO_2 RH_4	R_2O_5 RH_3	RO_3 RH_2	R_2O_7 RH	RO_4
Periods ↓	A B	A B	A B	A B	A B	A B	A B	Transition series
1	H 1.008							
2	Li 6.939	Be 9.012	B 10.81	C 12.011	N 14.007	O 15.999	F 18.998	
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4 First series:	K 39.102	Ca 40.08	Sc 44.96	Ti 47.90	V 50.94	Cr 50.20	Mn 54.94	Fe 55.85 Co 58.93 Ni 58.71
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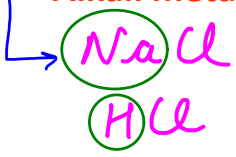
Second series:	Ag 107.87	Cd 112.40	In 114.82	Sn 118.69	Sb 121.75	Te 127.60	I 126.90	
6 First series:	Cs 132.90	Ba 137.34	La 138.91	Hf 178.49	Ta 180.95	W 183.85		Os 190.2 Ir 192.2 Pt 195.09
Second series:	Au 196.97	Hg 200.59	Tl 204.37	Pb 207.19	Bi 208.98			

Alkali metals



Halogens

Cl_2

H_2

Isotopes :- atoms of same element having same atomic number but different mass number.

$^{35}_{17}Cl$ $^{37}_{17}Cl$

2. He could not explain the position of isotopes :- Cl-35 and Cl-37 are the two isotopes of Chlorine which were placed in the same group although they had different masses.

Group	I	II	III	IV	V	VI	VII	VIII
Oxide Hydride	R_2O RH	RO RH_2	R_2O_3 RH_3	RO_2 RH_4	R_2O_5 RH_3	RO_3 RH_2	R_2O_7 RH	RO_4
Periods ↓	A B	A B	A B	A B	A B	A B	A B	Transition series
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3. He could not explain the wrong order of atomic masses of some elements :-

For example - Cobalt having mass 58.9 u was placed before Nickel which had mass 58.7 u.

Group	I	II	III	IV	V	VI	VII	VIII
Oxide Hydride	R_2O RH	RO RH_2	R_2O_3 RH_3	RO_2 RH_4	R_2O_5 RH_3	RO_3 RH_2	R_2O_7 RH	RO_4
Periods ↓	A B	A B	A B	A B	A B	A B	A B	Transition series
1	H 1.008							
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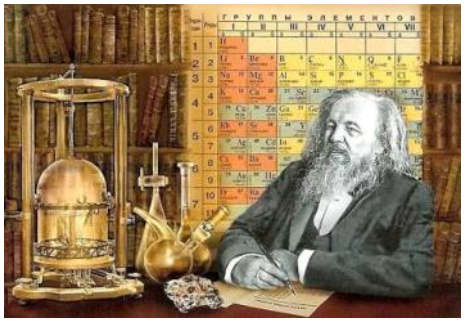
Q. State Mendeleev's periodic law of classification of elements.

Mendeleev's periodic law states that 'the properties of elements are periodic function of their atomic masses'.



Dmitri Ivanovich Mendeleev

Q. State modern periodic law. 2018

Q. State modern periodic law of classification of elements. 2013

Modern periodic law states that 'the properties of elements are periodic function of their atomic number'.

Henry Moseley

2018

Q. Name the scientist who first of all showed that atomic number of an element is a more fundamental property than its atomic mass.

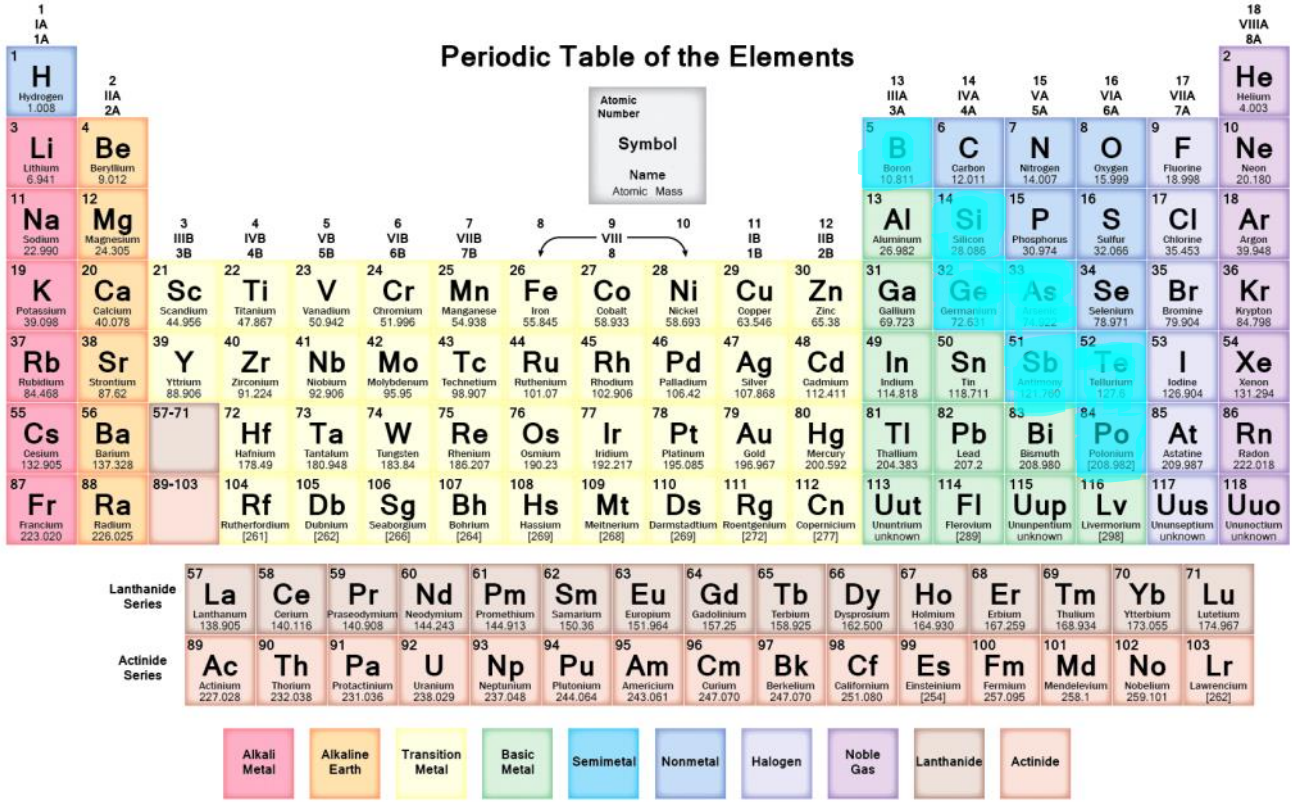
Ans. Henry Moseley

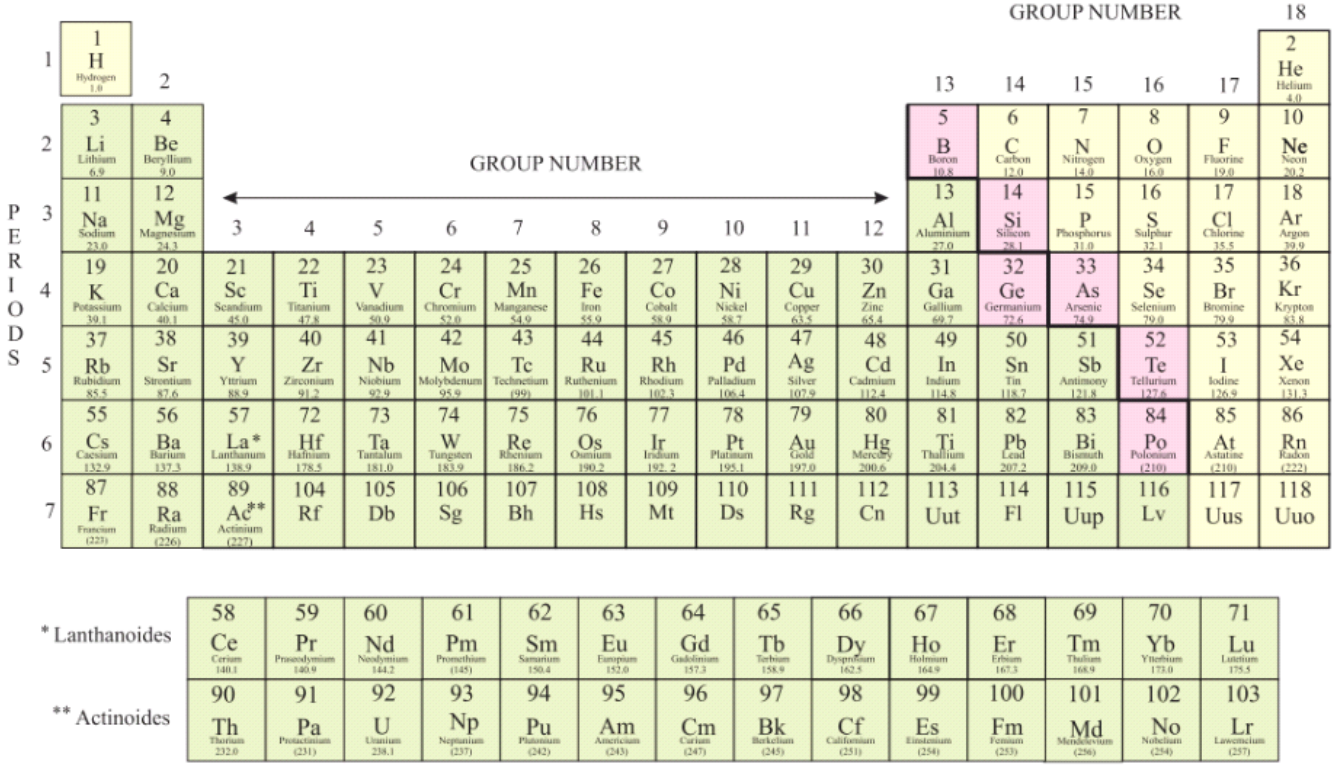
Henry Moseley

2018

Q. The Modern periodic table has been evolved through the early attempts of Dobereiner, Newland and Mendeleev. List one advantage and one limitation of all the three attempts.

Ans.


Periodic Table of the Elements
Atomic Number
Symbol
Name
Atomic Mass
1 IA 1A
2 IIA 2A
3 IIIB 3B
4 IVB 4B
5 VB 5B
6 VIB 6B
7 VIIB 7B
8 9 10 VIII 8
11 IB 1B
12 IIB 2B
13 IIIA 3A
14 IVA 4A
15 VA 5A
16 VIA 6A
17 VIIA 7A
18 VIIIA 8A
1 H Hydrogen 1.008
2 He Helium 4.003
3 Li Lithium 6.941
4 Be Beryllium 9.012
5 B Boron 10.811
6 C Carbon 12.011
7 N Nitrogen 14.007
8 O Oxygen 15.999
9 F Fluorine 18.998
10 Ne Neon 20.180
11 Na Sodium 22.990
12 Mg Magnesium 24.305
13 Al Aluminum 26.982
14 Si Silicon 28.086
15 P Phosphorus 30.974
16 S Sulfur 32.066
17 Cl Chlorine 35.453
18 Ar Argon 39.948
19 K Potassium 39.098
20 Ca Calcium 40.078
21 Sc Scandium 44.956
22 Ti Titanium 47.867
23 V Vanadium 50.942
24 Cr Chromium 51.996
25 Mn Manganese 54.938
26 Fe Iron 55.845
27 Co Cobalt 58.933
28 Ni Nickel 58.693
29 Cu Copper 63.546
30 Zn Zinc 65.38
31 Ga Gallium 69.723
32 Ge Germanium 72.631
33 As Arsenic 74.922
34 Se Selenium 78.971
35 Br Bromine 79.904
36 Kr Krypton 84.798
37 Rb Rubidium 84.468
38 Sr Strontium 87.62
39 Y Yttrium 88.906
40 Zr Zirconium 91.224
41 Nb Niobium 92.906
42 Mo Molybdenum 95.95
43 Tc Technetium 98.907
44 Ru Ruthenium 101.07
45 Rh Rhodium 102.906
46 Pd Palladium 106.42
47 Ag Silver 107.868
48 Cd Cadmium 112.411
49 In Indium 114.818
50 Sn Tin 118.711
51 Sb Antimony 121.760
52 Te Tellurium 127.6
53 I Iodine 126.904
54 Xe Xenon 131.294
55 Cs Cesium 132.905
56 Ba Barium 137.328
57-71
72 Hf Hafnium 178.49
73 Ta Tantalum 180.948
74 W Tungsten 183.84
75 Re Rhenium 186.207
76 Os Osmium 190.23
77 Ir Iridium 192.217
78 Pt Platinum 195.085
79 Au Gold 196.967
80 Hg Mercury 200.592
81 Tl Thallium 204.383
82 Pb Lead 207.2
83 Bi Bismuth 208.980
84 Po Polonium [208.982]
85 At Astatine 209.987
86 Rn Radon 222.018
87 Fr Francium 223.020
88 Ra Radium 226.025
89-103
104 Rf Rutherfordium [261]
105 Db Dubnium [262]
106 Sg Seaborgium [266]
107 Bh Bohrium [264]
108 Hs Hassium [269]
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 [298]
117 Uus Ununseptium unknown
118 Uuo Ununoctium unknown
Lanthanide Series
57 La Lanthanum 138.905
58 Ce Cerium 140.116
59 Pr Praseodymium 140.908
60 Nd Neodymium 144.243
61 Pm Promethium 144.913
62 Sm Samarium 150.36
63 Eu Europium 151.964
64 Gd Gadolinium 157.25
65 Tb Terbium 158.925
66 Dy Dysprosium 162.500
67 Ho Holmium 164.930
68 Er Erbium 167.259
69 Tm Thulium 168.934
70 Yb Ytterbium 173.055
71 Lu Lutetium 174.967
Actinide Series
89 Ac Actinium 227.028
90 Th Thorium 232.038
91 Pa Protactinium 231.036
92 U Uranium 238.029
93 Np Neptunium 237.048
94 Pu Plutonium 244.064
95 Am Americium 243.061
96 Cm Curium 247.070
97 Bk Berkelium 247.070
98 Cf Californium 251.080
99 Es Einsteinium [254]
100 Fm Fermium 257.095
101 Md Mendelevium 258.1
102 No Nobelium 259.101
103 Lr Lawrencium [262]
Alkali Metal
Alkaline Earth
Transition Metal
Basic Metal
Semimetal
Nonmetal
Halogen
Noble Gas
Lanthanide
Actinide


GROUP NUMBER
PERIODS
1 H Hydrogen 1.0
2 He Helium 4.0
3 Li Lithium 6.9
4 Be Beryllium 9.0
5 B Boron 10.8
6 C Carbon 12.0
7 N Nitrogen 14.0
8 O Oxygen 16.0
9 F Fluorine 19.0
10 Ne Neon 20.2
11 Na Sodium 23.0
12 Mg Magnesium 24.3
13 Al Aluminium 27.0
14 Si Silicon 28.1
15 P Phosphorus 31.0
16 S Sulphur 32.1
17 Cl Chlorine 35.5
18 Ar Argon 39.9
19 K Potassium 39.1
20 Ca Calcium 40.1
21 Sc Scandium 45.0
22 Ti Titanium 47.8
23 V Vanadium 50.9
24 Cr Chromium 52.0
25 Mn Manganese 54.9
26 Fe Iron 55.9
27 Co Cobalt 58.9
28 Ni Nickel 58.7
29 Cu Copper 63.5
30 Zn Zinc 65.4
31 Ga Gallium 69.7
32 Ge Germanium 72.6
33 As Arsenic 74.9
34 Se Selenium 79.0
35 Br Bromine 79.9
36 Kr Krypton 83.8
37 Rb Rubidium 85.5
38 Sr Strontium 87.6
39 Y Yttrium 88.9
40 Zr Zirconium 91.2
41 Nb Niobium 92.9
42 Mo Molybdenum 95.9
43 Tc Technetium (99)
44 Ru Ruthenium 101.1
45 Rh Rhodium 102.3
46 Pd Palladium 106.4
47 Ag Silver 107.9
48 Cd Cadmium 112.4
49 In Indium 114.8
50 Sn Tin 118.7
51 Sb Antimony 121.8
52 Te Tellurium 127.6
53 I Iodine 126.9
54 Xe Xenon 131.3
55 Cs Cacsium 132.9
56 Ba Barium 137.3
57 La* Lanthanum 138.9
72 Hf Hafnium 178.5
73 Ta Tantalum 181.0
74 W Tungsten 183.9
75 Re Rhenium 186.2
76 Os Osmium 190.2
77 Ir Iridium 192. 2
78 Pt Platinum 195.1
79 Au Gold 197.0
80 Hg Mercury 200.6
81 Ti Thallium 204.4
82 Pb Lead 207.2
83 Bi Bismuth 209.0
84 Po Polonium (210)
85 At Astatine (210)
86 Rn Radon (222)
87 Fr Francium (223)
88 Ra Radium (226)
89 Ac** Actinium (227)
104 Rf
105 Db
106 Sg
107 Bh
108 Hs
109 Mt
110 Ds
111 Rg
112 Cn
113 Uut
114 Fl
115 Uup
116 Lv
117 Uus
118 Uuo
* Lanthanoides
58 Ce Cerium 140.1
59 Pr Praseodymium 140.9
60 Nd Neodymium 144.2
61 Pm Promethium (145)
62 Sm Samarium 150.4
63 Eu Europium 152.0
64 Gd Gadolinium 157.3
65 Tb Terbium 158.9
66 Dy Dysprosium 162.5
67 Ho Holmium 164.9
68 Er Erbium 167.3
69 Tm Thulium 168.9
70 Yb Ytterbium 173.0
71 Lu Lutetium 175.5
** Actinoides
90 Th Thorium 232.0
91 Pa Protactinium (231)
92 U Uranium 238.1
93 Np Neptunium (237)
94 Pu Plutonium (242)
95 Am Americium (243)
96 Cm Curium (247)
97 Bk Berkelium (245)
98 Cf Californium (251)
99 Es Einsteinium (254)
100 Fm Fermium (253)
101 Md Mendelevium (256)
102 No Nobelium (254)
103 Lr Lawrencium (257)

Mini Modern Periodic Table

Group no	1	2	13	14	15	16	17	18
Valency	1	2	3	4	3	2	1	0
Valence e^-	1	2	3	4	5	6	7	8

1 H							2 He
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca						

Common name

Alkali Metals

Alkaline Earth metals

Halogens

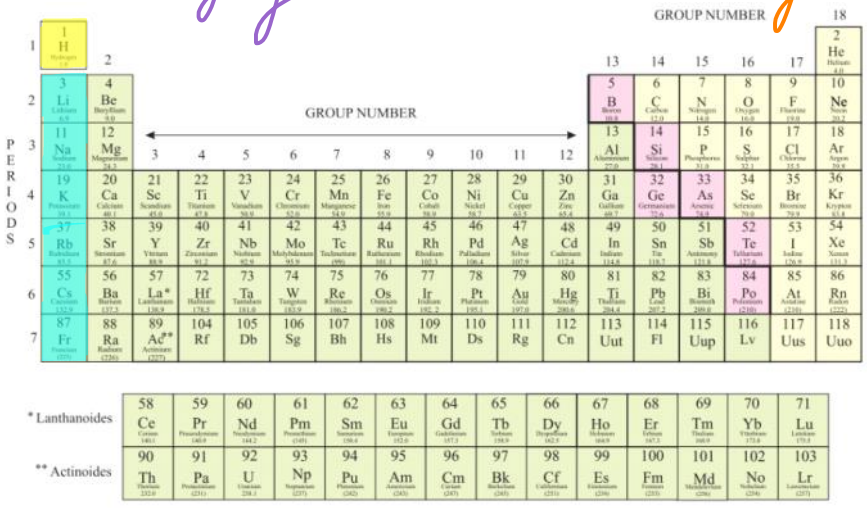
Noble gases

Group → 1 2 17 18

Modern Periodic Table

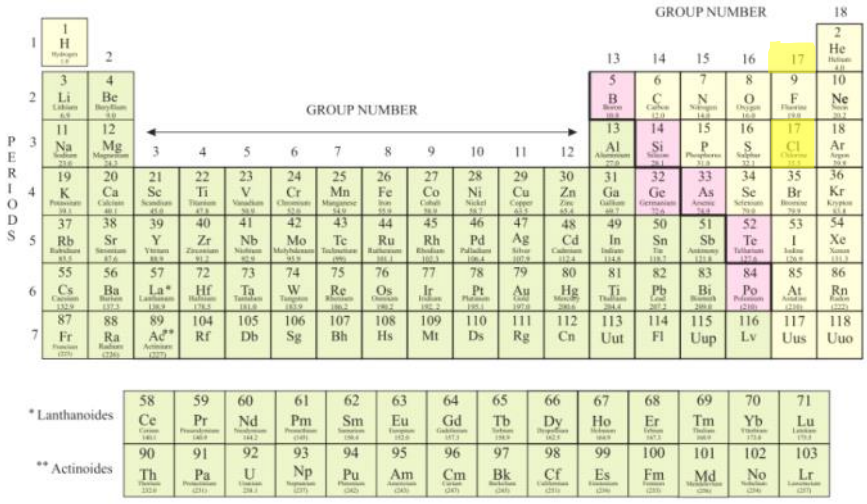
Q. How does the modern periodic table removes the anomalies of Mendeleev's periodic table ?

Ans. (i) Explanation of position of hydrogen :- Hydrogen is placed with group 1 elements at the top because the valence e^- of Hydrogen and alkali metals is 1. But hydrogen has small atomic size and many properties of hydrogen are different from alkali metals, so while studying the alkali metals, hydrogen is not included.

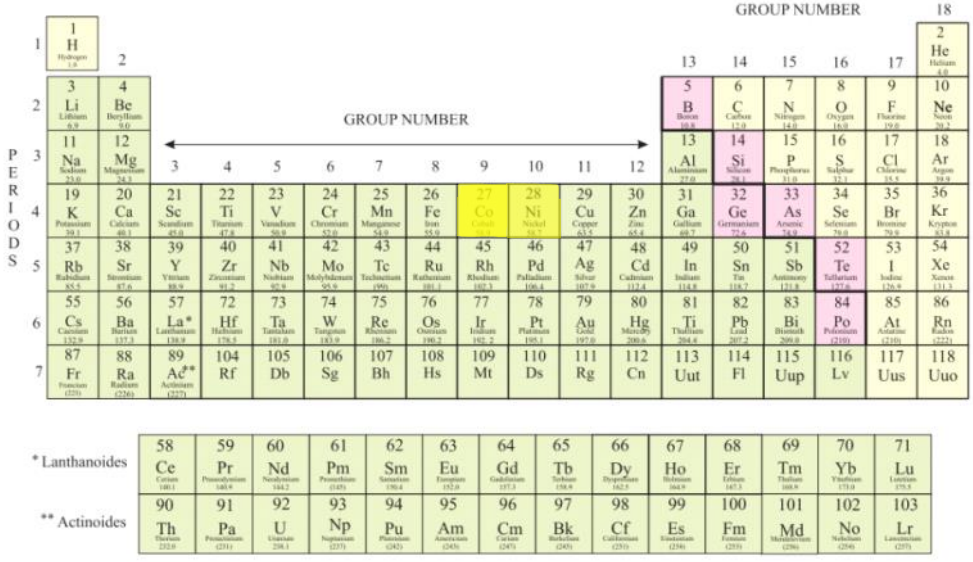


(ii) Explanation of position of isotopes :- Isotopes of the elements have same atomic number can be put in the same group. As the modern periodic table is based on atomic number.

For example – $^{35}_{17}Cl$ $^{37}_{17}Cl$ are placed in the same group.



(iii) Explanation of position of Cobalt and Nickel :- Since, modern periodic table was based on atomic number. So, cobalt having atomic number 27 came first & then nickel having atomic number 28.



Q. Distinguish between Mendeleev's periodic table and Modern periodic table.

Ans.

Mendeleev's periodic table	Modern periodic table
1. It has 8 groups and 6 periods.	1. It has 18 groups and 7 periods.
2. The elements are arranged in increasing order of atomic masses.	2. The elements are arranged in increasing order of atomic number.
3. Noble gases were not discovered at that time	3. Noble gases were placed in group – 18
4. Transition elements were placed in group – 8.	4. Transition elements were placed from group 3 to 12.

Q. Define the following terms: (i) Valency (ii) Atomic size

Ans. **(i) Valency :-** The combining capacity of an element is called its valency.

2014

→ Valency is determined by number of valence electrons. (e^- in outermost shell)

→ Valency is given by number of electrons lost or gained or shared by 1 atom to achieve inert gas configuration.

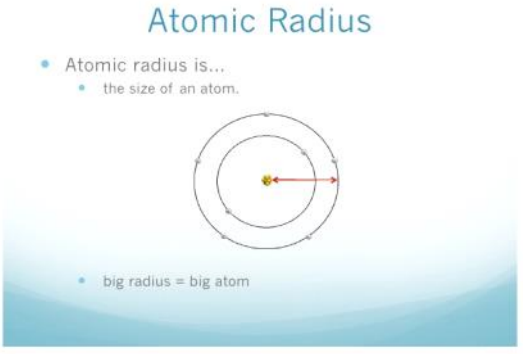
Valency → increases from 1 to 4 then decreases to 0.

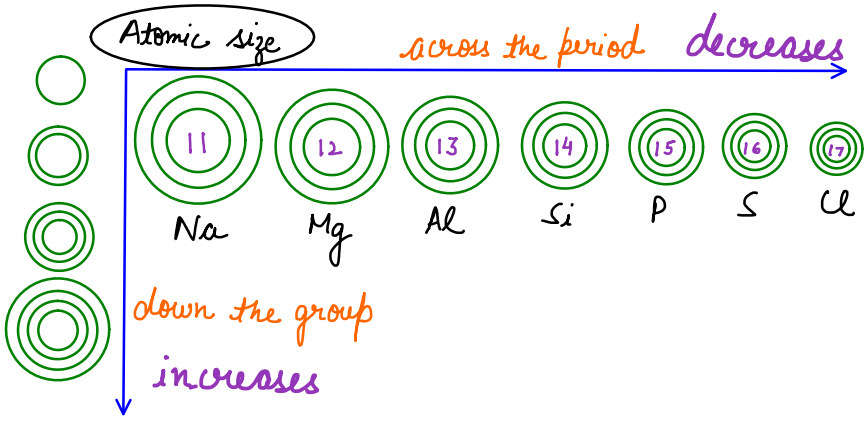
↓ same

PERIODS	GROUPS							
Valency	1	2	3	4	3	2	1	0
Group	1	2	13	14	15	16	17	18
Valence e^-	1	2	3	4	5	6	7	8
I	H (1)							He (2)
II	Li (2,1)	Be (2,2)	B (2,3)	C (2,4)	N (2,5)	O (2,6)	F (2,7)	Ne (2,8)
III	Na (2,8,1)	Mg (2,8,2)	Al (2,8,3)	Si (2,8,4)	P (2,8,5)	S (2,8,6)	Cl (2,8,7)	Ar (2,8,8)
IV	K (2,8,8,1)	Ca (2,8,8,2)						

(ii) Atomic Size :- It is the distance between centre of nucleus and the outermost shell.

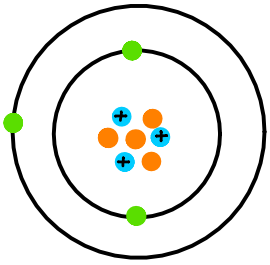
1 picometre = 10^{-12} metre (pm)



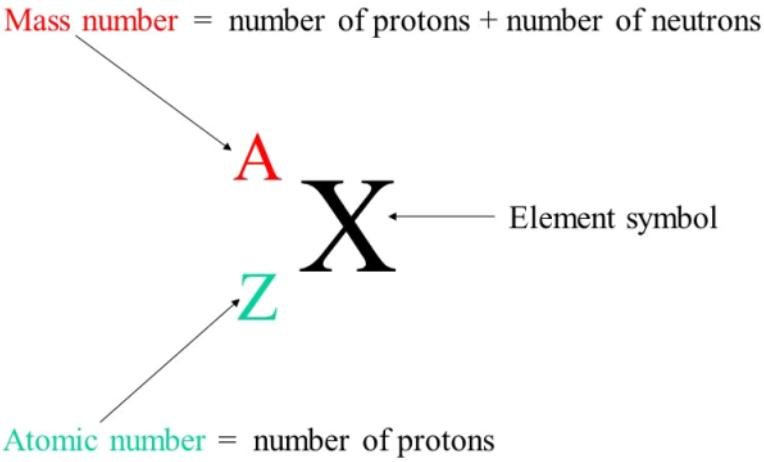


same

Atomic number, Mass number



$^{7}_{3}Li$



Isotopic Notation

Valence e^- → Group no.
Shell no. → Period no.

2019

Q. An element X has mass number 35 and number of neutrons 18. Write atomic number and electronic configuration of 'X'. Also write the group number, period number and valency of X.

Ans.

number of neutrons = Mass number - Atomic number

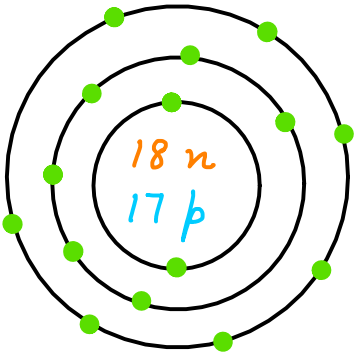
$n = A - Z$

$18 = 35 - Z$

$Z = 35 - 18$

$Z = 17$

$^{35}_{17}X$



Group number = 17^{th}

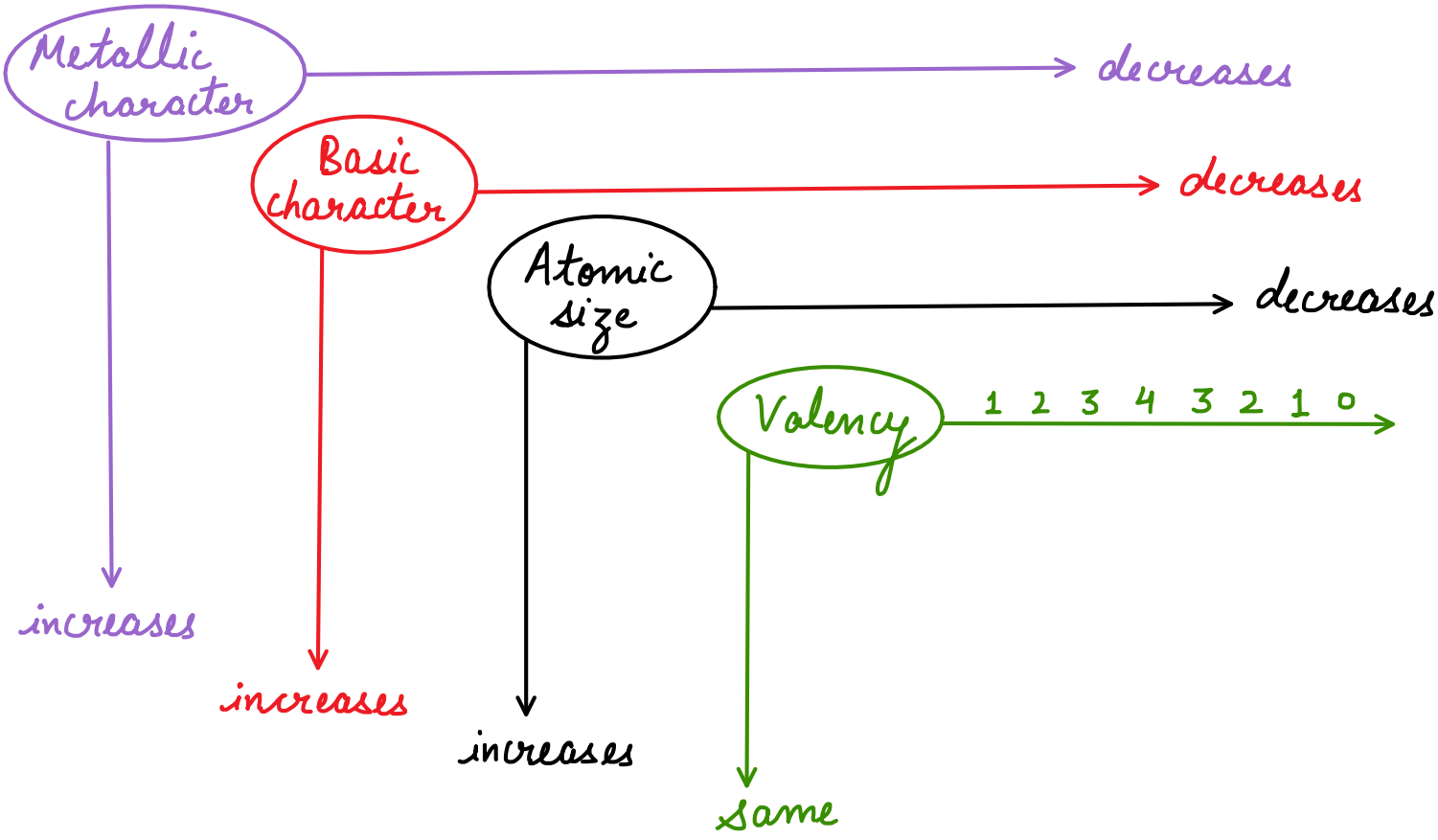
Period number = 3^{rd}

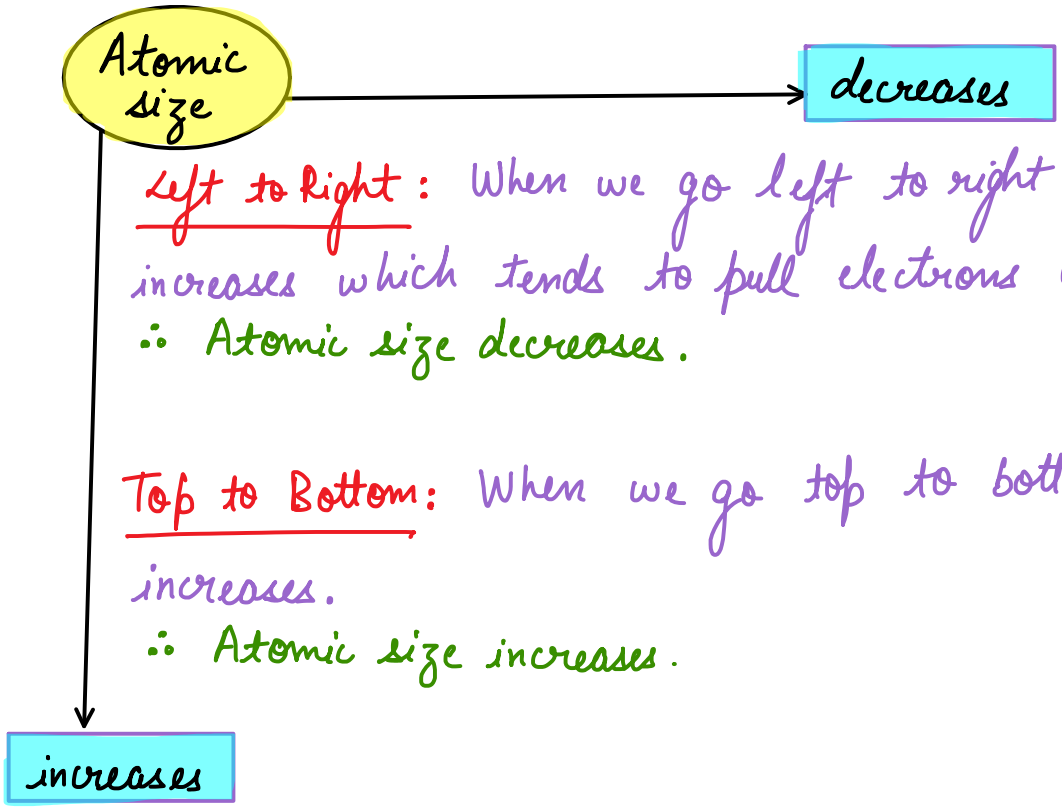
K L M

Valency = 1

Electronic configuration of X = 2, 8, 7

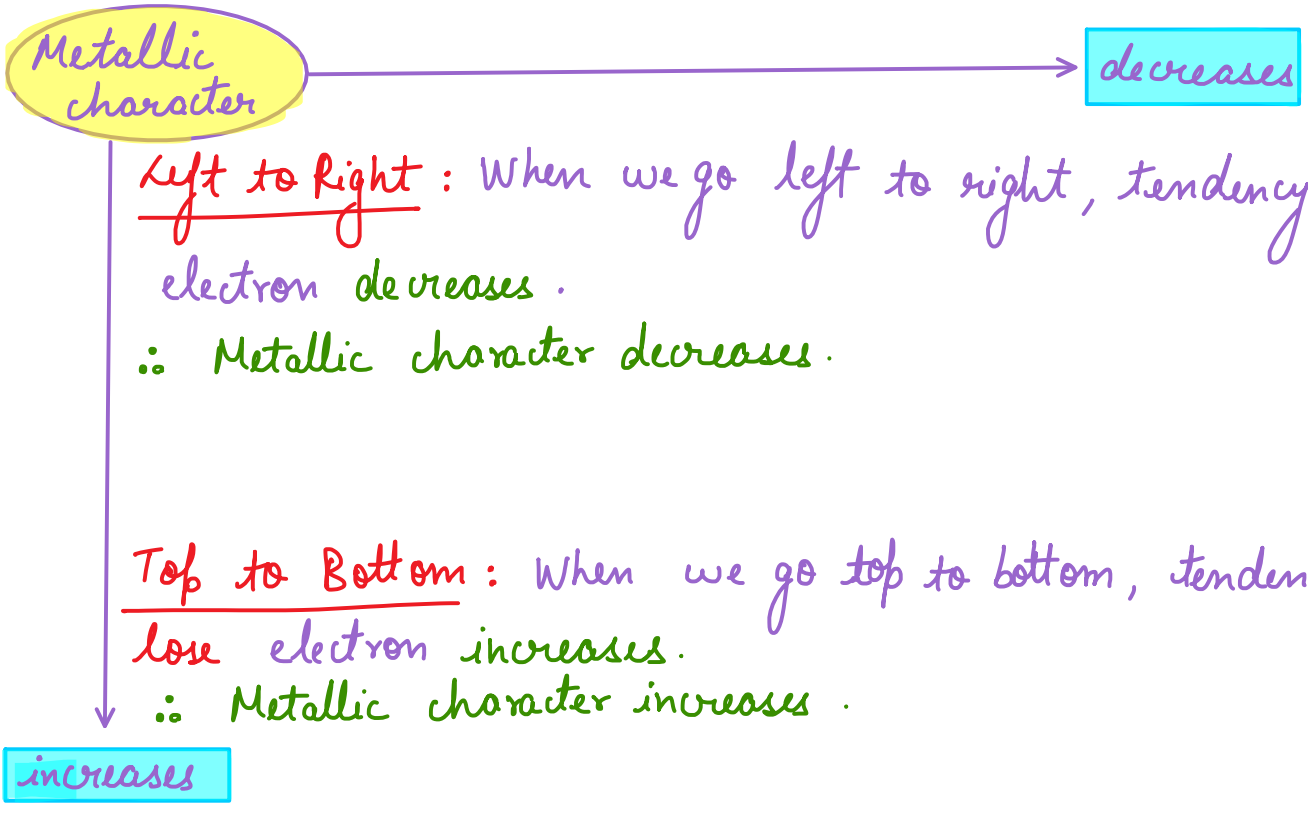
Trends in Modern Periodic Table





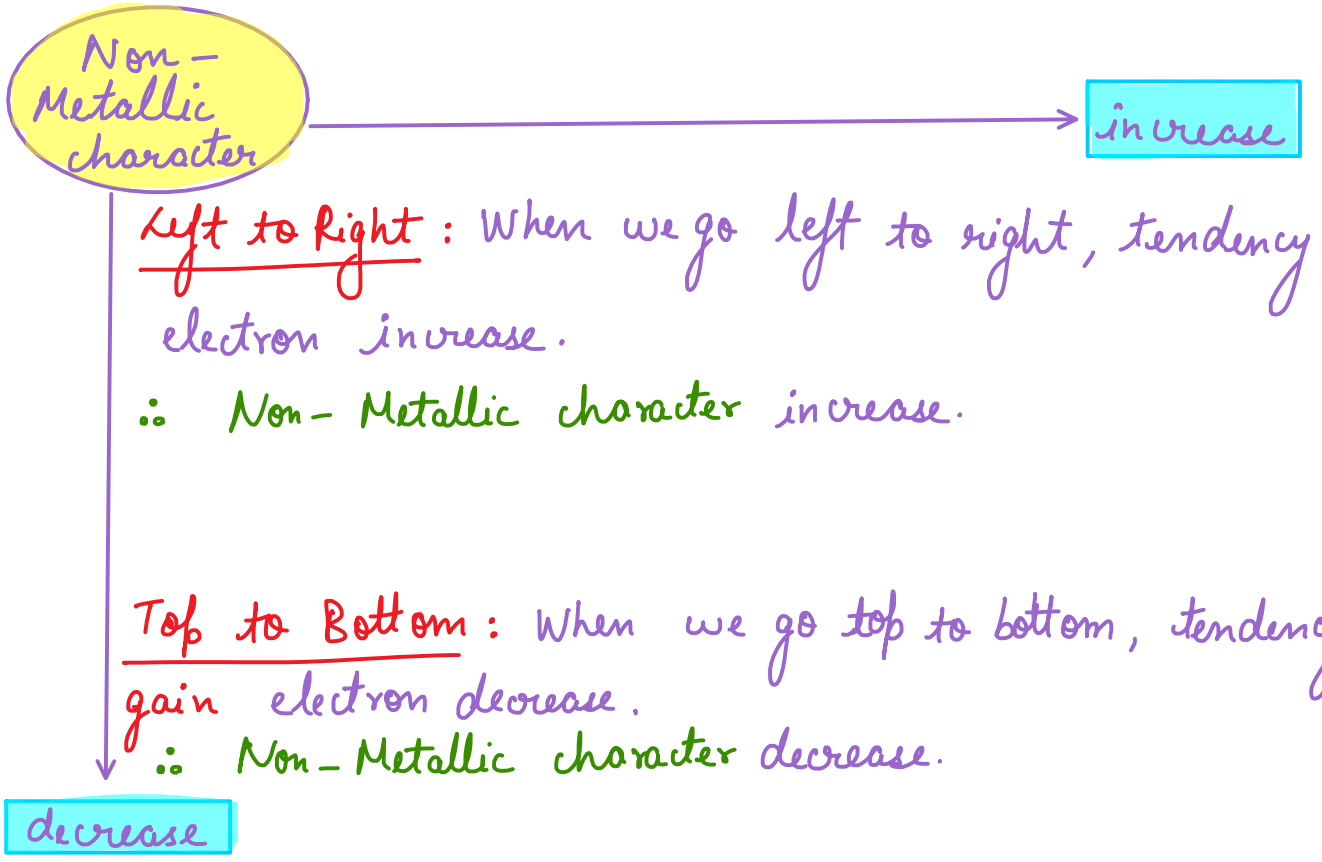
Left to Right : When we go left to right, effective nuclear charge increases which tends to pull electrons closer to the nucleus.
∴ Atomic size decreases.

Top to Bottom: When we go top to bottom, number of shells increases.
∴ Atomic size increases.



Left to Right : When we go left to right, tendency to lose electron decreases.
∴ Metallic character decreases.

Top to Bottom : When we go top to bottom, tendency to lose electron increases.
∴ Metallic character increases.



Left to Right : When we go left to right, tendency to gain electron increase.

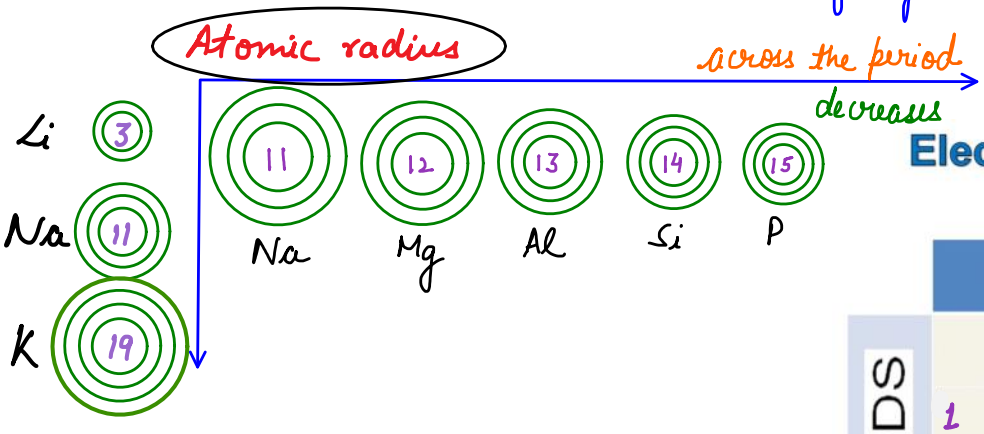
∴ Non-Metallic character increase.

Top to Bottom : When we go top to bottom, tendency to gain electron decrease.

∴ Non-Metallic character decrease.

Atomic size

Atomic size decreases as we go left to right in a period.
effective nuclear charge increases which tends to pull electrons closer to the nucleus and reduces the size of the atom.



Electronic Configuration of the first 20 Elements

PERIODS	GROUPS							
	1	2	13	14	15	16	17	18
1	H (1)							He (2)
2	Li (2,1)	Be (2,2)	B (2,3)	C (2,4)	N (2,5)	O (2,6)	F (2,7)	Ne (2,8)
3	Na (2,8,1)	Mg (2,8,2)	Al (2,8,3)	Si (2,8,4)	P (2,8,5)	S (2,8,6)	Cl (2,8,7)	Ar (2,8,8)
4	K (2,8,8, 1)	Ca (2,8,8, 2)						

Metallic Character

2019

Q. How does metallic character of elements in Modern periodic table vary on moving from

(i) left to right in a period ?

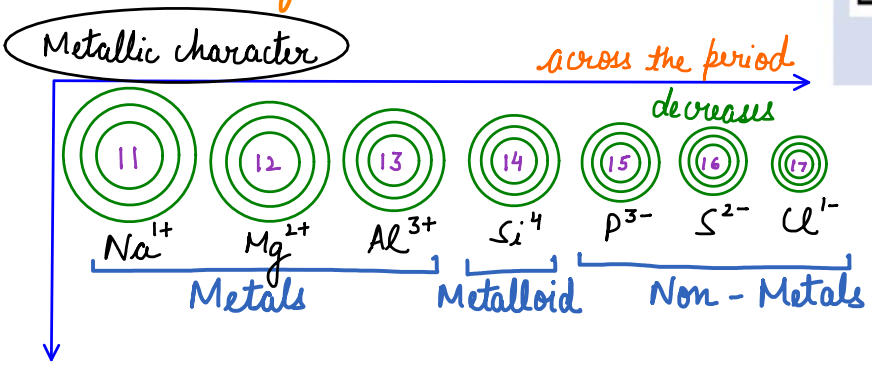
(ii) top to bottom in a group ?

Explain with the help of an example in each cas

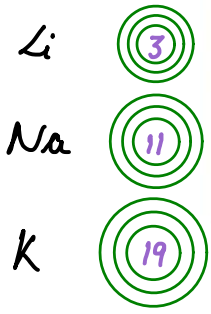
Ans. (i) Metallic character decreases as we move from left to right in a period. Because effective nuclear charge increases and tendency to lose e^- decreases.

Electronic Configuration of the first 20 Elements

PERIODS	GROUPS							
	1	2	13	14	15	16	17	18
1	H (1)							He (2)
2	Li (2,1)	Be (2,2)	B (2,3)	C (2,4)	N (2,5)	O (2,6)	F (2,7)	Ne (2,8)
3	Na (2,8,1)	Mg (2,8,2)	Al (2,8,3)	Si (2,8,4)	P (2,8,5)	S (2,8,6)	Cl (2,8,7)	Ar (2,8,8)
4	K (2,8,8, 1)	Ca (2,8,8, 2)						



(ii) Metallic character increases as we move from top to bottom in a group. Because effective nuclear charge decreases and tendency to lose e^- increases.



Electronic Configuration of the first 20 Elements

PERIODS	GROUPS 1	2	13	14	15	16	17	18
1	H (1)							He (2)
2	Li (2,1)	Be (2,2)	B (2,3)	C (2,4)	N (2,5)	O (2,6)	F (2,7)	Ne (2,8)
3	Na (2,8,1)	Mg (2,8,2)	Al (2,8,3)	Si (2,8,4)	P (2,8,5)	S (2,8,6)	Cl (2,8,7)	Ar (2,8,8)
4	K (2,8,8,1)	Ca (2,8,8,2)						

Table Questions

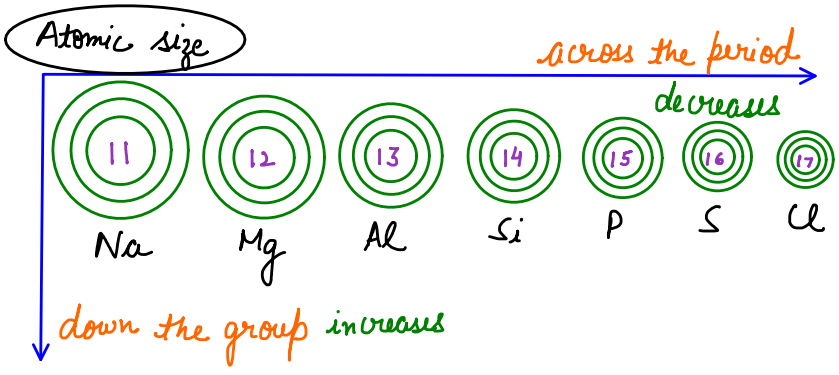
2013 **5 marks**

Q. The elements of the third period of the periodic table are given below:

Group ⟶	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**
Period 3 ⟶	**Na**	**Mg**	**Al**	**Si**	**P**	**S**	**Cl**

(a) Which atom is bigger, Na or Mg ? Why ?

Ans. Na is bigger because effective nuclear charge increases which tends to pull electrons closer to the nucleus and reduces the size of the atom.



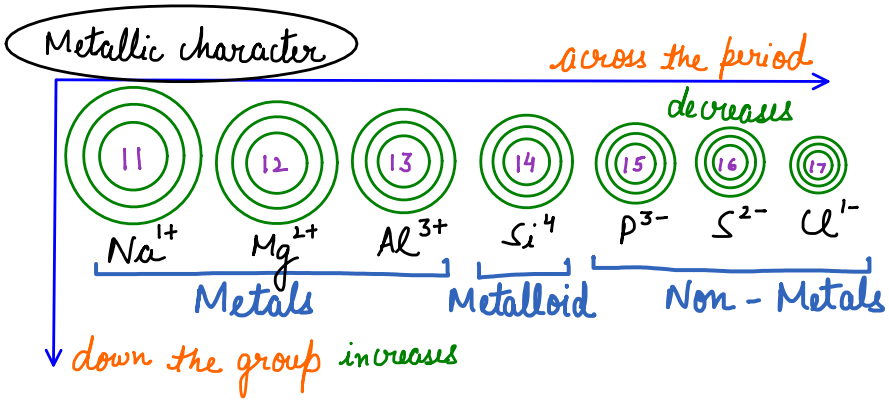
1 H							2 He
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca						

Q. The elements of the third period of the periodic table are given below:

Group ⟶	I	II	III	IV	V	VI	VII
Period 3 ⟶	Na	Mg	Al	Si	P	S	Cl

(b) Identify the most (i) metallic and (ii) non-metallic element in period 3.

Ans. (i) Na (ii) Cl



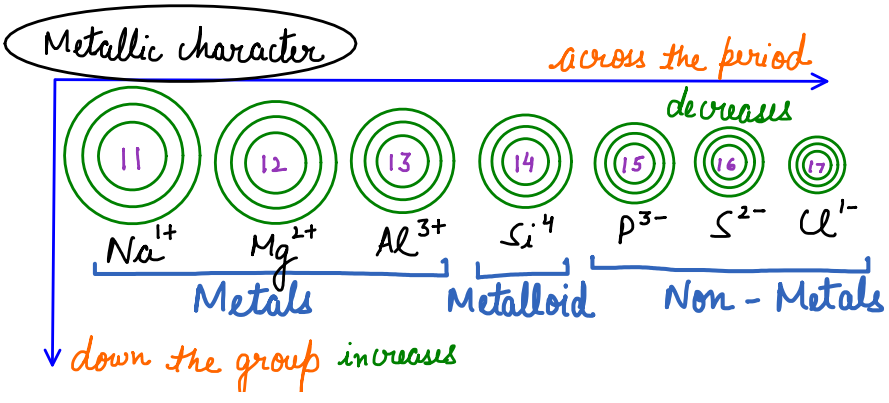
1 H							2 He
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca						

Q. The elements of the third period of the periodic table are given below:

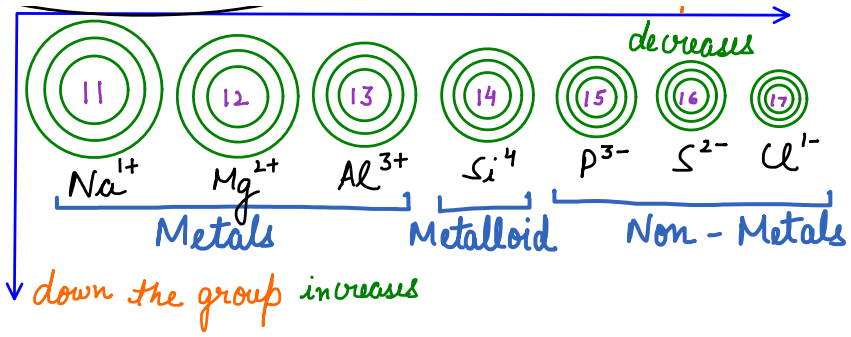
Group ⟶	I	II	III	IV	V	VI	VII
Period 3 ⟶	Na	Mg	Al	Si	P	S	Cl

(c) Which is more non-metallic, S or Cl ?

Ans. Cl



1 H							2 He
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar



1 H							2 He
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca						

Q. The elements of the third period of the periodic table are given below:

Group →	I	II	III	IV	V	VI	VII
Period 3 →	Na	Mg	Al	Si	P	S	Cl

(d) Which has higher atomic mass, Al or Cl ?

Ans. Cl

Electronic Configuration Questions

2013

Q. The electronic configuration of an element 'X' is 2,8,8,2. To which (a) period and (b) group of the modern periodic table does 'X' belong ? State its valency. Justify your answer in each case.

Ans.

K L M N

Electronic configuration is 2, 8, 8, 2.

(a) It belongs to the 4th period because it has 4 shells.

(b) It belongs to the 2nd group because it has 2 valence e⁻.

→ Valency :- 2, because it loses 2e⁻ to achieve inert gas configuration.

Valence e⁻ → Group no.

Shell no. → Period no.

	GROUPS							
Valency	1	2	3	4	3	2	1	0
Group	1	2	13	14	15	16	17	18
Valence e⁻	1	2	3	4	5	6	7	8
PERIODS 1	H (1)							He (2)
2	Li (2,1)	Be (2,2)	B (2,3)	C (2,4)	N (2,5)	O (2,6)	F (2,7)	Ne (2,8)
3	Na (2,8,1)	Mg (2,8,2)	Al (2,8,3)	Si (2,8,4)	P (2,8,5)	S (2,8,6)	Cl (2,8,7)	Ar (2,8,8)
4	K (2,8,8,1)	Ca (2,8,8,2)						

Questions

Q. (a) Name the element with atomic number 17.
(b) To which period does it belong ?
(c) To which group does it belong ?
(d) Write its electronic configuration.

Electronic Configuration of the first 20 Elements

PERIODS	GROUPS 1	2	13	14	15	16	17	18
1	H (1)							He (2)
2	Li (2,1)	Be (2,2)	B (2,3)	C (2,4)	N (2,5)	O (2,6)	F (2,7)	Ne (2,8)
3	Na (2,8,1)	Mg (2,8,2)	Al (2,8,3)	Si (2,8,4)	P (2,8,5)	S (2,8,6)	Cl (2,8,7)	Ar (2,8,8)
4	K (2,8,8, 1)	Ca (2,8,8, 2)						

Ans. (a) Chlorine $_{17}Cl$ = K 2, L 8, M 7

(b) 3rd period → (3 shells)

(c) 17th group → (7 valence e^-)

(d) Electronic configuration of $_{17}Cl$ = K 2, L 8, M 7

Valence e^- → Group no.
Shell no. → Period no.

Table Questions

Group → / Period ↓	1	2	3-12	13	14	15	16	17	18
2	A					B			C
3				D	E				F

2014

Q. On the basis of above table, answer the following questions :

(i) Name the element which forms covalent compounds.

Ans. E

Group number = 14

Valence e^- = 4 (share $4e^-$)

(ii) Name the element which is a metal with valency three.

Ans. D

Group number = 13

Valence e^- = 3 (lose $3e^-$) → Metal $^{3+}$

(iii) Name the element which is a non-metal with valency three.

Ans. B

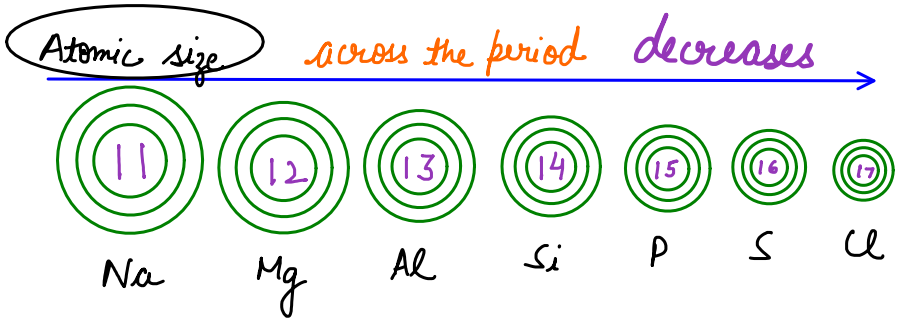
Group number = 15

Valence e^- = 5 (gain $3e^-$) → Non-Metal $^{3-}$

Group → / Period ↓	1	2	3-12	13	14	15	16	17	18
2	A					B			C
3				D	E				F

(iv) Out of D and E, which is bigger in size and why ?

Ans. D Atomic size decreases from left to right across a period because effective nuclear charge increases which tends to pull electrons closer to the nucleus and reduces the size of the atom.



Group → / Period ↓	1	2	3-12	13	14	15	16	17	18
2	A					B			C
3				D	E				F

(v) Write the common name for the family to which elements C and F belong.

Ans. Noble gases. 18th group → (Noble gases) or (Inert gases)

Q. Using the table answer the following questions :-

Period ↓ / Group →	1	2	13	14	15	16	17
1	G						H
2	A		I	E		B	C
3		D					F

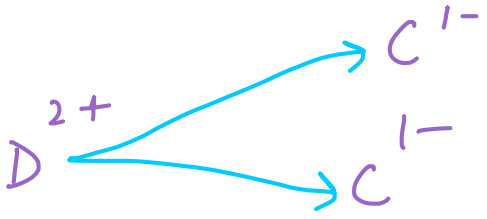
(i) Which element will form only covalent compounds and why ?

(ii) Out of which A, I, B which has most metallic character and why ?

Period ↓ / Group →	1	2	13	14	15	16	17
1	G						H
2	A		I			B	C
3		D		E			F

Period ↓ / Group →	1	2	13	14	15	16	17
1	G						H
2	A		I			B	C
3		D		E			F

(iii) Show the bond formation between D and C and also mention the type of bond formed.



DC_2

Q. Amongst the following elements identify the ones that would form anions:

K , O , Na , F , Ca , Cl , Mg

Ans.

$_{19}K \rightarrow 2, 8, 8, (1)$ K^{1+}

$_{11}Na \rightarrow 2, 8, (1)$ Na^{1+}

$_{20}Ca \rightarrow 2, 8, 8, (2)$ Ca^{2+}

$_{12}Mg \rightarrow 2, 8, (2)$ Mg^{2+}

Cations

$_{8}O \rightarrow 2, (6)$ O^{2-}

$_{9}F \rightarrow 2, (7)$ F^{1-}

$_{17}Cl \rightarrow 2, 8, (7)$ Cl^{1-}

Anions

PERIODS	GROUPS							
	1	2	13	14	15	16	17	18
1	H (1)							He (2)
2	Li (2,1)	Be (2,2)	B (2,3)	C (2,4)	N (2,5)	O (2,6)	F (2,7)	Ne (2,8)
3	Na (2,8,1)	Mg (2,8,2)	Al (2,8,3)	Si (2,8,4)	P (2,8,5)	S (2,8,6)	Cl (2,8,7)	Ar (2,8,8)
4	K (2,8,8, 1)	Ca (2,8,8, 2)						

Q. Write the electronic configuration of anions identified above.

Ans. $O^{2-} = 2, 8$

$F^{1-} = 2, 8$

$Cl^{1-} = 2, 8, 8$

Questions

Q. An element belongs to the third period and second group of the periodic table:

(a) State number of valence electrons in it.

(b) Is it a metal or a non-metal ?

(c) Name the element.

(d) Write its electronic configuration.

Electronic Configuration of the first 20 Elements

	GROUPS							
PERIODS	1	2	13	14	15	16	17	18
1	H (1)							He (2)
2	Li (2,1)	Be (2,2)	B (2,3)	C (2,4)	N (2,5)	O (2,6)	F (2,7)	Ne (2,8)
3	Na (2,8,1)	Mg (2,8,2)	Al (2,8,3)	Si (2,8,4)	P (2,8,5)	S (2,8,6)	Cl (2,8,7)	Ar (2,8,8)
4	K (2,8,8, 1)	Ca (2,8,8, 2)						

Ans.

(a) Valence e^- = 2 K L M 2, 8, (2)

(b) Metal → (lose $2e^-$)

(c) Magnesium

(d) Electronic configuration of $_{12}Mg$ = 2, 8, 2

Q. The elements Be , Mg and Ca each having two electrons in their outermost shells are in periods 2, 3 and 4 respectively of the modern periodic table. Answer the following questions, giving justification in each case:

(i) Write the group to which these elements belong.

(ii) Name the least reactive element.

(iii) Name the element having largest atomic radius.

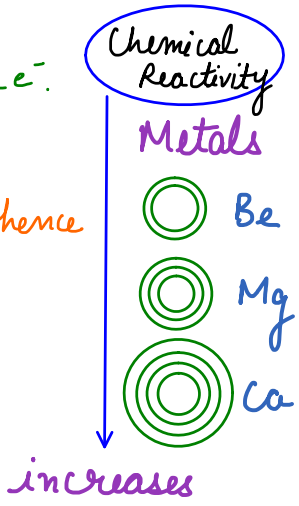
Electronic Configuration of the first 20 Elements

PERIODS	GROUPS 1	2	13	14	15	16	17	18
1	H (1)							He (2)
2	Li (2,1)	Be (2,2)	B (2,3)	C (2,4)	N (2,5)	O (2,6)	F (2,7)	Ne (2,8)
3	Na (2,8,1)	Mg (2,8,2)	Al (2,8,3)	Si (2,8,4)	P (2,8,5)	S (2,8,6)	Cl (2,8,7)	Ar (2,8,8)
4	K (2,8,8, 1)	Ca (2,8,8, 2)						

Ans. (i) Group - 2
because they all have 2 valence e⁻.

(ii) Be because as we go down tendency to lose e⁻ increases hence chemical reactivity increases in metals.

(iii) Ca because it has 4 shells.



2019

Q. Answer the following questions based on the elements with atomic number 3 to 9 :

(a) Name the element with smallest atomic radius.

Ans.

Electronic Configuration of the first 20 Elements

PERIODS	GROUPS							
	1	2	13	14	15	16	17	18
1	H (1)							He (2)
2	Li (2,1)	Be (2,2)	B (2,3)	C (2,4)	N (2,5)	O (2,6)	F (2,7)	Ne (2,8)
3	Na (2,8,1)	Mg (2,8,2)	Al (2,8,3)	Si (2,8,4)	P (2,8,5)	S (2,8,6)	Cl (2,8,7)	Ar (2,8,8)
4	K (2,8,8,1)	Ca (2,8,8,2)						

(b) Name the element which shows maximum valency.

(c) Name the element which is a metalloid.

(d) Name the element which is most electropositive.

1+ 2+ 3+ 4 3− 2− 1−

Li Be B C N O F

Metal

Electronic Configuration of the first 20 Elements

PERIODS	GROUPS 1	2	13	14	15	16	17	18
1	H (1)							He (2)
2	Li (2,1)	Be (2,2)	B (2,3)	C (2,4)	N (2,5)	O (2,6)	F (2,7)	Ne (2,8)
3	Na (2,8,1)	Mg (2,8,2)	Al (2,8,3)	Si (2,8,4)	P (2,8,5)	S (2,8,6)	Cl (2,8,7)	Ar (2,8,8)
4	K (2,8,8,1)	Ca (2,8,8,2)						

(e) Write the chemical formula of the compound formed when the elements of atomic number 6 and 8 react together.

2019

Q. If an element X is placed in group 14, what will be the nature of bond in its chloride ? Write the chemical formula of the compound formed.

X → Valency 4

Cl → Valency 1

XCl_4

Q. An element with atomic number 13. Identify its position in table.

Q. Two elements X (11) and Y (13) ; which will be more reactive and why ?

Q. Where do you think should hydrogen be placed in modern periodic table ?