4 Periodic Properties

One of the greatest intellectual achievements in chemistry is the periodic table of the elements. The periodic table can be printed on a single sheet of paper, but what it contains and can teach us is enormous and beyond measure. The periodic table is the outcome of continuous effort, beginning in ancient Greece, to understand the true nature of matter. It can rightly be called the Bible of chemistry.

There are about 118 elements known at present and it is very difficult to study the properties of all these elements separately. So, all the elements have been divided into a few groups in such a way that elements in the same group have similar properties.

The value of the periodic table is not only in its organisation of known information, but also in its ability to predict unknown properties. The true greatness of the periodic table lies in that ability.

Dobereiner's Triads: According to Dobereiner's law of triads (1829). When elements are arranged in the order of increasing atomic masses, groups of three elements (known as triads) having similar chemical properties are obtained.

The atomic mass of the middle elements is triad being equal to the arithmetic mean of the atomic masses of the other two elements.

Example: **The alkali metal group**

Element					**Atomic mass**
Lithium	-	Li	-	7	$\left(\frac{7+39}{2}\right)$
Sodium	-	Na	-	23	$=\frac{46}{2}=23$
Potassium	-	K	-	39	

The Alkali Earth Metal Group

Calcium	-	Ca	-	40
Strontium	-	Sr	-	88
Barium	-	Ba	-	137

The Limitation of Dobereiner's Classification: It failed to arrange all the then known elements in the form of triads of elements having similar chemical properties. Dobereiner could identify only three triads from the elements known at that time.

Newland's Law of Octaves (1864)

When elements are arranged in the order of increasing atomic masses, the properties of the eighth element (starting from a given element) are a repetition of the properties of the first element. This repetition in the properties of elements is just like the repetition of eight notes in an octave of music. This classification gave a very important conclusion that there is some systematic relationship between the order of atomic masses and repetition of properties of elements.

Limitations

- This law was applicable to the classification of elements up to calcium only.
- New lands assumed that only 56 elements exist in nature and no more elements would be discovered in the future.
- Fe (iron) element which resembles cobalt and nickel elements in properties was placed far away from their elements.

Mendeleev's Periodic Table

I	II	III	IV	V	VI	VII	VIII		
H 1.01									
Li 6.94	Be 9.01	B 10.8	C 12.0	N 14.0	O 16.0	F 19.0			
Na 23.0	Mg 24.3	Al 27.0	Si 28.1	P 31.0	S 32.1	Cl 35.5			
K 39.1	Ca 40.1		Tl 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			As 74.9	Se 79.0	Br 79.9			
Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9		Ru 101	Rh 103	Pd 106
Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128	I 127			
Ce 133	Ba 137	La 139		Ta 181	W 184		Os 194	Ir 192	Pt 195
Au 197	Hg 201	Ti 204	Pb 207	Bl 209					
			Th 232		U 238				

"The properties of elements are a periodic function of their atomic masses". Sixty three elements were there at that time Mendeleev concentrated on the compounds formed by elements with oxygen and hydrogen he selected hydrogen and oxygen as they are very reactive and formed compounds with most elements.

Mendeleev's periodic table contains vertical columns called groups and horizontal rows called periods. There were 7 periods and 8 groups in periodic table. Noble gases were not known at that time. So, there was no group of noble gases.
The elements in each group of the periodic table are similar to one another in many properties. The similar properties of the elements are repeated periodically.

Merits of Mendeleev's Classification

- Mendeleev's periodic law predicated the existence of some elements that has not been discovered at that time.
- Could predict the properties of several elements on the basis of their position in the periodic table.
- Could accommodate noble gases when they were discovered.

Limitations of Mendeleev's Classification

- The position of isotopes could not be explained.
- Wrong order of atomic masses of some elements could not be explained.
- A correct position could not be assigned to hydrogen in the periodic table.

Advantages of the Modern Periodic Table over Mendeleev's Periodic Table

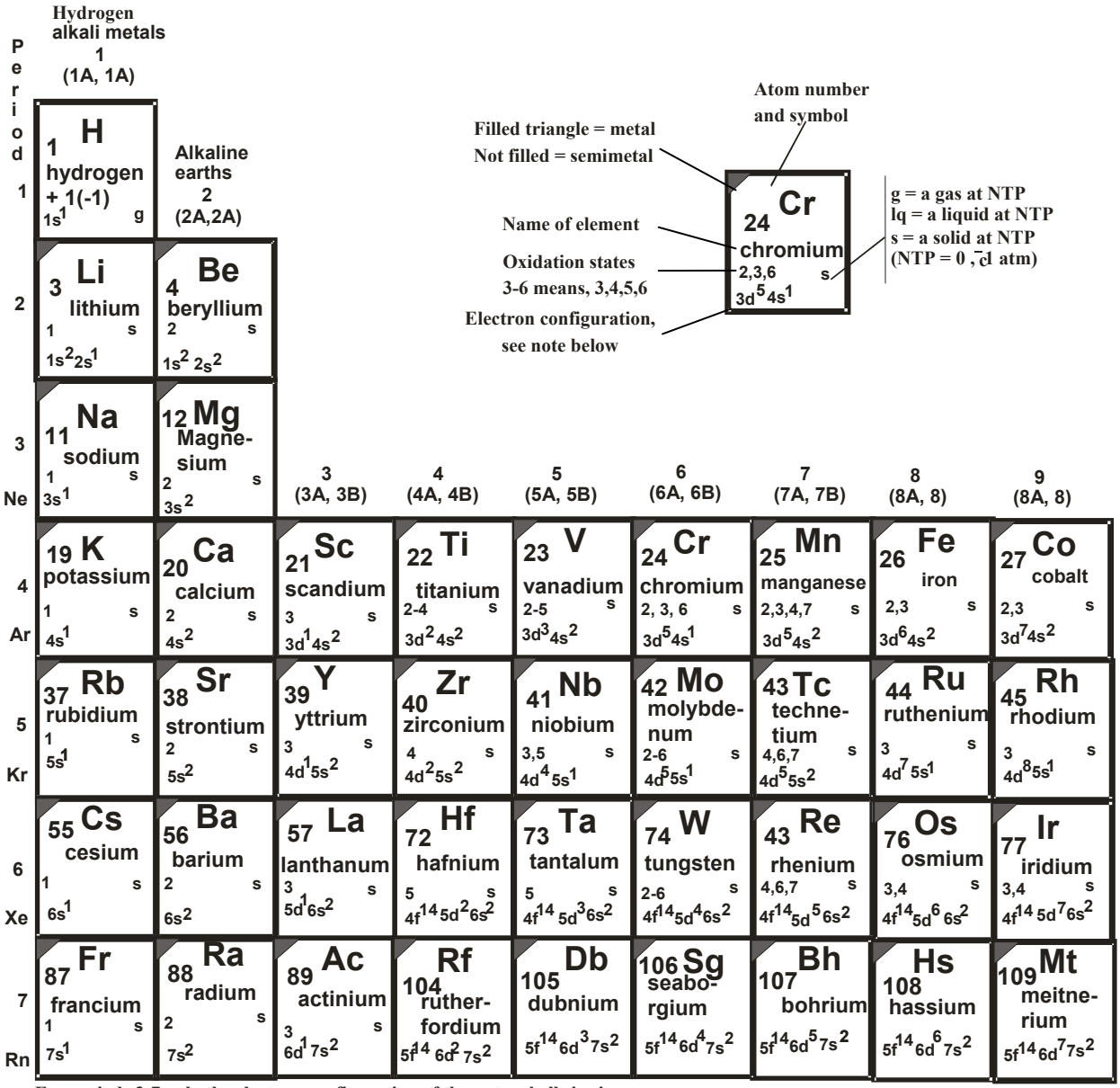
- The modern periodic table is based on the most fundamental property, the atomic number of elements, while Mendeleev's periodic table is based upon the atomic mass of elements.
- In the modern periodic table, elements are arranged in accordance with their electronic configuration. Elements with the similar electronic configuration are placed in the same group. Therefore, elements in a given group show similar properties. Elements with different electronic configurations are grouped separately, hence they show different properties.
  Mendeleev's periodic table does not provide any basis for the similarity and the difference in properties of elements.
- The modern periodic table gives a satisfactory explanation about the chemical periodicity in the properties of elements. The periodicity in properties arises due to periodicity in electronic configurations of elements. Since the electronic configuration of elements are repeated at regular intervals, the properties of elements are bound to do so.
  Mendeleev's periodic table does not assign any reason for the periodicity in properties of elements.
- In Mendeleev's periodic table there are several anomalies, e.g., the position of isotopes, wrong order of atomic masses of some elements, etc. In the long form of the periodic table, these anomalies have been removed.
- In the long form of the periodic table, elements have been clearly separated as normal elements, transition elements and noble gases. Metals and non-metals are also separated. But in Mendeleev's periodic table there is no such separation of different types of elements.
- In the modern periodic table the subgroups A and B of Mendeleev's periodic table are clearly separate but the numbering of groups has been as 1, 2, 3, up to 18.

Learn Tedious Modern Periodic Table Just in 10 Minutes. By Learning Following Seven Sentences:

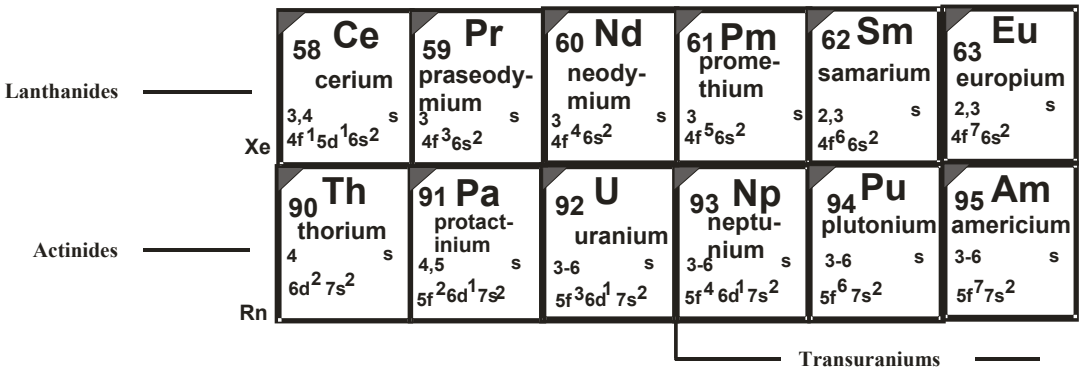
- H Headline
- Little Best B C NOF Needs
- Natural Magnetism Alarms Sin People Should Clear Arms
- King CaSc TiV Cry Mnemonically Feel Country Nine Cubic Zone "GaGe" As Seen Brave Kremlin
- Rb Sri Yama Zero Number Mobike-Tc Run Right Pride Against Cadmium; In Snow Sb Tea Insure Xenophobia
- Cs Ban X Hf TaW Refused Oscar Irrelevant Platinum Gold; Mercury, Telecasts Publicly Big Port At Rn
- Front Radar # Reflects Double Segment Behind House Master; DSO Registration Can Neither File Mercy Living Test Orgy.

Modern periodic table has also been divided into four blocks; *s, p, d* and *f* on the basis of the sub-shell in which the ***s*-block**, ***d*-block** and ***f*-block** contain metals, while ***p*-block** contains metals, non-metals and semi-metals. In the periodic table metals have been separated from non-metals by some elements called metalloids. Elements having one valance electron are placed in group 1 and having 2 valence electrons are placed in group 2 and so on elements having 8 valence electrons are placed in group 18.

MODERN PERIODIC TABLE



For periods 3-7 only the electron configuration of the outer shells is given
Add the configuration for the inert gas at the extreme left.



The groups (columns) are now called 1-18. Earlier there were two systems: the IUPAC system and the CAS version. These old notations are found within parentheses with the IUPAC form first.

10 (8A,8)	Coin metals 11 (1B,1B)	12 (2B,2B)	Boron group 13 (3B,3A)	Carbon group 14 (4B,4A)	Nitrogen group 15 (5B,5A)	Oxygen group 16 (6B,6A)	Halo-gens 17 (7B,7A)	Inert gases 18 (0,8A)
								2 **He** helium 0 g $1s^2$
			5 **B** boron 3 s $1s^2 2s^2 2p^1$	6 **C** carbon ±4(2) g $1s^2 2s^2 2p^2$	7 **N** nitrogen * g $1s^2 2s^2 2p^3$	8 **O** oxygen -2(-1) g $1s^2 2s^2 2p^4$	9 **F** fluorine -1 g $1s^2 2s^2 2p^5$	10 **Ne** neon 0 g $1s^2 2s^2 2p^6$
			13 **Al** aluminum 3 s $3s^2 3p^1$	14 **Si** silicon 2±4 s $3s^2 3p^2$	15 **P** phosph-orus s $3s^2 3p^3$	16 **S** sulphur -2,4,6 s $3s^2 3p^4$	17 **Cl** chlorine ±1,5,7 g $3s^2 3p^5$	18 **Ar** argon 0 g $3s^2 3p^6$
28 **Ni** nickel 2,3 s $3d^8 4s^2$	29 **Cu** copper 1,2 s $3d^{10} 4s^1$	30 **Zn** zinc 2 s $3d^{10} 4s^2$	31 **Ga** gallium 3 s $3d\ 4s^2 4p^1$	32 **Ge** germa-nium 2,4 s $3d^{10} 4s^2 4p^2$	33 **As** arsenic ±3,5 s $3d^{10} 4s^2 4p^3$	34 **Se** selenium -2,4,6 s $3d^{10} 4s^2 4p^4$	35 **Br** bromine ±1,5 1q $3d^{10} 4s^2 4p^5$	36 **Kr** krypton 0 g $3d^{10} 4s^2 4p^6$
46 **Pd** palladium 2,4 s $4d^{10}$	47 **Ag** silver 1 s $4d^{10} 5s^1$	48 **Cd** cadmium 2 s $4d^{10} 5s^2$	49 **In** indium 3 s $4d^{10} 5s^2 5p^1$	50 **Sn** tin 2,4 s $4d^{10} 5s^2 5p^2$	51 **Sb** antimony ±3,5 s $4d^{10} 5s^2 5p^3$	52 **Te** tellurium -2,4,6 s $4d^{10} 5s^2 5p^4$	53 **I** iodine ±1,5,7 s $4d^{10} 5s^2 5p^5$	54 **Xe** xenon 0 g $4d^{10} 5s^2 5p^6$
78 **Pt** platinum 2,4 s $4f^{14} 5d^9 6s^1$	79 **Au** gold 1,3 s $4f^{14} 5d^{10} 6s^1$	80 **Hg** mercury 1,2 1q $4f^{14} 5d^{10} 6s^2$	81 **Tl** thallium 1,3 s Hg + $6p^1$	82 **Pb** lead 2,4 s Hg + $6p^2$	83 **Bi** bismuth 3,5 s Hg + $6p^3$	84 **Po** polonium 2,4 s Hg + $6p^4$	85 **At** astatine ±1,5,7 s Hg + $6p^5$	86 **Rn** radon 0 g Hg + $6p^6$
110 **Ds** Darmsta dtium $5f^{14} 6d^8 7s^2$	111 **Rg** Roentge nium $5f^{14} 6d^9 7s^2$	112 **Cn** Coperni cium $5f^{14} 6d^{10} 7s^2$	113 **Nh** Nihonium $5f^{14} 6d^{10} 7s^2 7p^1$	114 **Fl** Flerovium $5f^{14} 6d^{10} 7s^2 7p^2$	115 **Mc** Moscovium $5f^{14} 6d^{10} 7s^2 7p^3$	116 **Lv** Livermo rium $5f^{14} 6d^{10} 7s^2 7p^4$	117 **Ts** Tenne ssine $5f^{14} 6d^{10} 7s^2 7p^5$	118 **Og** Ogane sson $5f^{14} 6d^{10} 7s^2 7p^6$

*Nitrogen can have oxidation states -1, -2, -3, 1,2,3,4,5

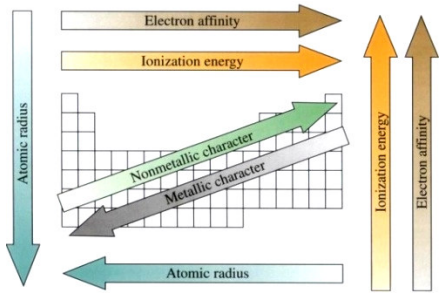
Heavy platinum metals: Os, Ir, and Pt

Light platinum metals: Ru, Rh, and Pd

Rare earths: Sc, Y, La, and Lanthanides

64 **Gd** gado-linium 3 s $4f^7 5d^1 6s^2$	65 **Tb** terbium 3 s $4f^9 6s^2$	66 **Dy** dyspro-sium 3 s $4f^{10} 6s^2$	67 **Ho** holmium 3 s $4f^{11} 6s^2$	68 **Er** erbium 3 s $4f^{12} 6s^2$	69 **Tm** thulium 3 s $4f^{13} 6s^2$	70 **Yb** ytterbium 2,3 s $4f^{14} 6s^2$	71 **Lu** lutetium 3 s $4f^{14} 5d^1 6s^2$
96 **Cm** curium 3 $5f^7 6d^1 7s^2$	97 **Bk** berkelium 3,4 $5f^9 7s^2$	98 **Cf** califo-rnium 3 $5f^{10} 7s^2$	99 **Es** einstei-nium $5f^{11} 7s^2$	100 **Fm** fermium 3-6 s $5f^{12} 7s^2$	101 **Md** mendele-vium $5f^{13} 7s^2$	102 **N0** nobelium 2,3 $5f^{14} 7s^2$	103 **Lr** lawren-cium 3? $5f^{14} 6d^1 7s^2$

Modern Periodic Law: "Properties of elements are a periodic function of their atomic number.**"**



Trends in the Modern Periodic Table

- **Valency:** No. of valence electrons present in the outermost shells.
- **Atomic Size:** Atomic size refers to radius of an atom.
- Atomic size or radius decreases in moving from left to right along a period due to increase in nuclear charge
- Atomic size increases down the group because new shells are being added as we go down the group.
- The valance shells of all the noble gases are completely filled with elements.

Characteristics of Periods and groups

Valance Electrons: On moving from left to right in a period, the number of valance electrons in elements increases from 1 to 8 (in first period it increases from 1 to 2). All the elements of a group of the periodic table have the same number of valance electrons.

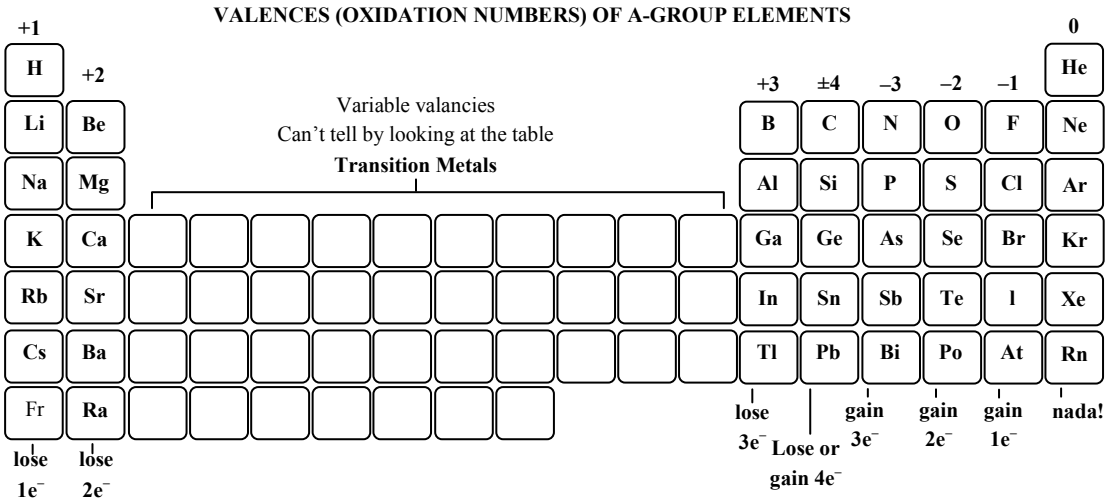


Table: 4.1 Period

11	12	13	14	15	16	17
Na	Mg	Al	Si	P	S	Cl
2, 8, 1	2, 8, 2	2, 8, 3	2, 8, 4	2, 8, 5	2, 8, 6	2, 8, 7

Third Period	Na	Mg	Al	Si	P	S	Cl	Ar
Valency	1	2	3	4	3	2	1	0

Group Group –1 Li - 2, 1
Na - 2, 8, 1
K - 2, 8, 8, 1

Table: 4.2 The valency increases from 1 to 4 and then decreases to 0 (zero)

Groups: All elements in a group have the same valency.

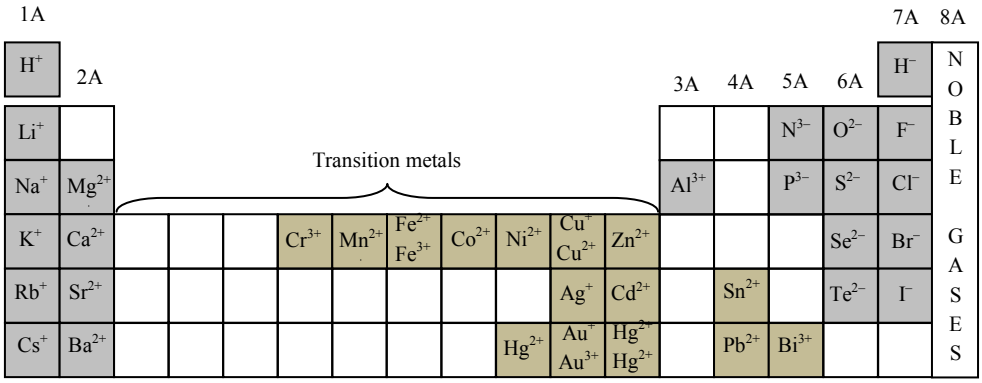


Table: 4.3 Ions of Periodic Groups

Group/Name	Characteristics of Ion
Group 1/Alkali Metals	**Noble gas' electron configuration**: Loses one electron to have a charge of +1. *Also applies to Hydrogen (H^+) even though it's not an alkali metal.
Group 2/Alkaline Earth Metals	**Noble gas' electron configuration**: Loses two electrons to have a charge of +2
Groups 3-12/Transition Metals	**Electron configuration with half-full or full d-orbital** A few transition metals form two ions, and it's best to just know them: Copper (Cu^+ & Cu^{2+}) Iron (Fe^{2+} & Fe^{3+}), Mercury (Hg^+ & Hg^{2+}), and Tin (Sn^{2+} & Sn^{4+}) A few transition metals have a specific ion despite the number of valence electrons: Chromium (Cr^{3+}), Nickel (Ni^{2+}), Silver (Ag^+), Zinc (Zn^{2+})
Group 13	These elements often choose between losing and gaining electrons to get to **noble gas' electron configuration** (they can go either way) * Aluminum is an exception: Al^{3+}
Group 14	These elements can lose a different number of electrons to achieve stability **e.g.:** Sn can lose 2 electrons to get a full s-orbital or 4 electrons to get to **noble gas' electron configuration** * Lead can only be Pb^{2+}
Group 15	**Noble gas' electron configuration**: Gains 3 electrons to have a charge of –3
Group 16	**Noble gas' electron configuration**: Gains 2 electrons to have a charge of –2
Group 17/Halogens	**Noble gas' electron configuration**: Gains 1 electron to have a charge of –1
Group 18/Noble gases	No ion due to existing stable electron configuration of 8 valence-shell electron

Metallic Character:

Metallic character means the tendency of an atom to lose electrons;

- Metallic character decreases across a period because the effective nuclear charge increases that means the tendency to lose electrons decreases.
- Metals are electropositive as they tend to lose electrons while forming bonds.
- Metallic character increases as we go down a group as the effective nuclear charge is decreasing. Non-metals are electronegative. They tend to form bonds by gaining electrons.
- Metals are found on the left side of the period table while non-metals are towards the right hand side of the periodic table.
- In the middle we have semi-metals or metalloid because they exhibit some properties of both metals and non metals.
- Oxides of metals are basic in nature while oxides of non-metals are acidic in nature.
- **Period:** Metallic character decreases but non-metallic increases

Na Mg Al	Si	PS Cl
Metals	Metalloid	Non - metal

Gradation in Periodic Properties

Property	Variation across period	Reason	Variation along group	Reason
Atomic size	Decreases	Due to increase in nuclear charge	Increases	Due to addition of new shells
Ionization energy (He; highest IE)	Increases	With increase in atomic number or decrease in atomic size.	Decreases	Because the size increases and distance between nucleus and outer most electron increases.
Electron affinity (Cl; highest EA)	Increases	Due to atomic size decreases.	Decreases	Due to atomic radii increases.
Electron negativity	Increases	Increases from left to right along with the period.	Decreases	From top to bottom in a given group.
Metallic character	Decreases	Due to increase in effective nuclear charge tendency to lose valence electron decreases.	Increases	Due to decreases in effective nuclear charge tendency to lose valence electron increases.
Non-metallic character	Increases	Due to increase in effective nuclear charge tendency to gain electrons increases.	Decreases	Due to decrease in effective nuclear charge tendency to gain electron decreases.
Chemical reactivity	From left to right first decreases and then increases.		In metals increases on going down and in non-metals decreases on going down.	
Nature of oxides	Left to right the basic nature of oxides decreases and the acidic nature of oxides increases.		On going down in a group there is no change in the nature of oxides of elements. Metals are elector positive; Non-metals are electronegative.	

Multiple Choice Questions

1. Law of Triad was proposed by
a. Newland **b.** Gay Lussac
c. Mendeleev **d.** Dobereiner

2. The period that contains only gaseous elements are
a. 1 **b.** 2
c. 3 **d.** 4

3. The longest and the shortest periods are
a. 1 and 6 **b.** 2 and 6
c. 6 and 1 **d.** 1 and 7

4. The numbers of elements present in the 2nd, 3rd, 4th and 5th periods of the modern periodic table are
a. 2 ,8,8,18 **b.** 8,8,18,32
c. 8,8,18, 18 **d.** 8,18,18,32

5. The pairs of elements with the following atomic numbers have the same chemical properties
a. 13 and 12 **b.** 3 and 11
c. 4 and 24 **d.** 2 and 1

6. Which amongst the following are called magic numbers?
a. 2,8,8,18 **b.** 2,8,8,32
c. 2,8,18,32 **d.** None of these

7. Elements with atomic number 15 and mass number 31 is present in
a. Group 5 and period 4
b. Group5 and period 3
c. Group15 and period 3
d. Group15 and period 4

8. Element 'X' has 12 protons in its nucleus. To which group of the periodic table it will belong
a. 1 **b.** 2
c. 6 **d.** 8

9. An element has 12 neutrons in its nucleus. To which group of the periodic table it will belong?
a. 1 **b.** 2
c. 6 **d.** Impossible to predict

10. Which of the following will form acidic oxide? An element with atomic number
a. 7 **b.** 11
c. 21 **d.** 19

11. Which amongst the following represents the correct order of decreasing metallic character of elements Na, Si, Cl, Mg, Al?
a. Cl > Si > Al > Mg > Na
b. Na > Mg > Al > Si > Cl
c. Na > Si > Mg > Al > Cl
d. Al > Na > Si > Cl > Mg

13. Where would you locate an element with electronic configuration 2, 8, 7 in the modern periodic table?
a. Group 7 and period 2
b. Group7 and period 3
c. Group 17 and period 3
d. Group17 and period 3

12. Which of the following are characteristics of isotopes of an element?
(i) Isotopes of an element have same atomic masses
(ii) Isotopes of an element have same atomic number
(iii) Isotopes of an element show same physical properties
(iv) Isotopes of an element have same chemical properties
a. i, iii, iv **b.** ii, iii, iv
c. ii and iii **d.** ii and iv

14. Which of the given elements A, B, C, D and E with atomic numbers 2, 4, 8, 10 and 18 respectively belong to the same period?
a. A, B, C **b.** B, C, D
c. A, D, E **d.** B, D, E

15. Which of the following hydroxides are most basic?
a. $Be(OH)_2$ **b.** $Mg(OH)_2$
c. $Ca(OH)_2$ **d.** $Ba(OH)_2$

16. Which of the following is the correct order of size?
a. $I^+ > I^- > I$ **b.** $I^- > I > I^+$
c. $I > I^+ > I^-$ **d.** $I > I^- > I^+$

17. Which of the following is the correct order of size?
a. Cl < F < Br < I **b.** F < Cl < Br < I
c. I < Br < Cl < F **d.** Br < I < Cl < F

18. The lightest metal is
a. Li **b.** Na
c. K **d.** Mg

19. Which of the following has most non metallic character?
a. N **b.** C
c. O **d.** F

20. The most metallic element in the fourth period is:
a. Ca **b.** K **c.** S **d.** P

21. An element has 13 protons. The group and period to which it belongs
a. 3rd period and 13th group
b. 2nd period and 13th group
c. 3rd period and 3rd group
d. 2nd period and 3rd group

22. On moving horizontally across a period, the number of electrons in the outermost shell increases from ___ to ___
a. 2, 8 **b.** 2, 18
c. 1, 8 **d.** 1, 18

23. A liquid non-metal is _____
a. Phosphorous **b.** Mercury
c. Bromine **d.** Nitrogen

24. Lanthanides and actinides are also called _____
a. normal elements **b.** transition elements
c. noble gases **d.** inner transition elements

25. Which of the following elements would lose an electron easily?
a. K **b.** Na
c. Ca **d.** Mg

26. The modern periodic table is given by _____
a. Mendeleev **b.** Einstein
c. Bohr **d.** Mosley

27. Which of the following is not noble gas?
a. Helium **b.** Xenon
c. Radium **d.** Radon

28. At the end of each period the valence shell is _____
a. incomplete **b.** half filled
c. singly occupied **d.** completely filled

29. Which of the following elements would accept an electron readily?
a. F **b.** C
c. Br **d.** I

30. Element 'A' has electronic configuration 2, 7 'B' has configuration 2, 8, 6 'C' has configuration 2, 8, 8 while 'D' has 2, 8, 7. Which element will show similar chemical properties?
a. A and D **b.** A and C
c. B and D **d.** B and C

31. An element has configuration 2, 8, 1. It belongs to, _____
a. 1 group and 3rd period
b. 3 group and 1st period
c. 1 group and 8th period
d. 17 group and 3rd period

32. Six elements A, B, C, D, E and F have the following atomic numbers (A = 12, B = 17, C = 18, D = 7, E = 9 and F = 11). Among these elements, the element, which belongs to the 3rd period and has the highest ionisation potential, is
a. A **b.** B
c. C **d.** F

33. The element with electronic configuration 2, 8, 6 is
a. Metallic with valency 2
b. Non-metallic with valency 2
c. Metalloid with valency 2
d. None of these

34. Elements belonging to the same group have similar properties because
a. They have similar electronic configuration of the outermost shell
b. Their atomic numbers go on increasing as we move down the group
c. All of them are metallic elements
d. None of the above

35. Elements in a period have same
a. Number of valence electrons
b. Valency
c. Number of shells
d. Volume

36. Most electropositive element is
a. H **b.** Mg
c. Ca **d.** Si

37. Most electronegative element belongs to
a. Group 17 **b.** Group 18
c. Group 15 **d.** None of these

38. Which one of the following has the smallest size?
a. Al **b.** Al^{+}
c. Al^{+2} **d.** Al^{+3}

39. The elements belongs to which group called representative elements
a. group 1 and 2
b. group 3 and 12
c. group 13 and 18
d. element lying at the bottom of periodic table

40. The element with lowest IE_1 is:
a. Sodium **b.** Barium
c. Cesium **d.** Magnesium

41. Which amongst the following element can from amphoteric oxide?

a. Mg **b.** N

c. C **d.** Al

42. The elements of the group 16 are also called

a. Chalcogens

b. Halogens

c. Noble gases

d. Alkaline earth metals

43. The element with atomic number 9 resembles with the element having atomic number.

a. 8 **b.** 36

c. 27 **d.** 17

44. The elements in the middle of the periodic table are called

a. Metalloids

b. Rare earth elements

c. Transition elements

d. Noble gases

45. The general name of the elements of 17^{th} group

a. Hydrides

b. Halogens

c. Noble gases

d. None of these

46. Halogen is belongs to which group of the modern periodic table?

a. s-block **b.** p-block

c. d-block **d.** f-block

47. The element with highest electron affinity in the periodic table is

a. Iodine **b.** Chlorine

c. Fluorine **d.** None of these

48. The statement that is not true about electron affinity is

a. It causes energy to be released

b. It causes energy to be absorbed

c. It is expressed in electron volts

d. It involves formation of an anion

49. A factor that affects the ionisation potential of an element is

a. atomic size **b.** electron affinity

c. electronegativity **d.** neutrons

50. Which of the following properties generally decrease along a period?

a. Ionisation energy**b.** Electron affinity

c. Metallic character **d.** Valency

ANSWERS

1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**
d	a	c	b	b	c	c	b	d	a
11.	**12.**	**13.**	**14.**	**15.**	**16.**	**17.**	**18.**	**19.**	**20.**
b	c	b	b	d	b	b	a	d	b
21.	**22.**	**23.**	**24.**	**25.**	**26.**	**27.**	**28.**	**29.**	**30.**
a	c	c	d	a	d	c	d	b	a
31.	**32.**	**33.**	**34.**	**35.**	**36.**	**37.**	**38.**	**39.**	**40.**
a	c	b	a	c	c	a	d	a	c
41.	**42.**	**43.**	**44.**	**45.**	**46.**	**47.**	**48.**	**49.**	**50.**
d	a	d	c	b	b	b	b	a	c

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