X Chemistry: Periodic Classification of elements

Gist of Lesson for Quick Revision (By JSUNIL)

1. Periodic table: The table which classifies all the known elements on the basis of their properties in such a way that elements with similar properties are grouped together.

The first classification of elements was as metals and non-metals. This served only limited purpose mainly because of two reasons: (i). All the elements were grouped in to these two classes only. The group containing metals was very big. (ii) Some elements showed properties of both-metals and non-metals and they could not be placed in any of the two classes.

2. All earlier attempts on the classification of the elements were based on their atomic weights.

3. The first attempt towards the classification of elements was made by Johann Dobereiner, a German chemist in 1829. He made sets of three elements which showed similar chemical properties and he called it triads.

4. The Triad was approximately the mean of the atomic weights of the other two members and the properties of the middle element were in between those of the other two members.

5. The average of the atomic masses of Li and K =1/2(7+39)= 23 (Na)

5. The major drawback of Dobereiner classification was that the concept of triads could be applied to limited number of elements. It was also possible to group quite dissimilar elements into triads.

6. Lithium, Sodium, Potassium are called **Alkalies metal** as they react with metal and form alkalies (**Caustic solution**)

7. Calcium, Strontium, Bromine are called **Alkalies Earth metal** as they react with metal and form salt . as their oxide are alkalies in nature and exist in the Earth

8. Chlorine, Bromine, Iodine are called **Halogen** as their oxide are alkalies in nature and exist in the Earth

9. In 1864 John Alexander Newland, an English chemist noticed that “when elements are arranged in the increasing order of their atomic masses. He found that "every eighth element had properties similar to the first element.”

10. Newland called this as the Law of Octaves due to its similarity with musical notes .

11. Newland could arrange elements in this manner only up to calcium (atomic mass 40) out of a total of over sixty elements known at his time.

12. No Place were given for forth coming elements by Newland.

13. . Newland placed unlike elements in same slot like Co and Ni placed with F , Cl and Iodine

14. When Nobel gases were discovered in 1900 law of octave fail and 9th element became similar to 1st. in Newland Octave

15. Doberenier‘s triads also exist in the column of Newland octaves like Li, Na, K.

16. In1869 Mendeleev a Russian chemist while trying to classify elements discovered that on arranging in the increasing order of atomic mass, elements with similar chemical properties occurred periodically.

17. A periodic function is the one which repeats itself after a certain interval.

18. According to the periodic law : The chemical and physical properties of elements are a periodic function of their atomic masses.

19. Mendeleev believed that atomic mass of elements was the most fundamental property. A tabular arrangement of the elements based on the periodic law is called periodic table.

20. The Seven horizontal rows present in the periodic table are called periods.

21. Properties of elements in a particular period increase or decrease from left to right.

22. The nine vertical columns present in it are called groups and are numbered from I to VIII and Zero (Roman numerals).

23. Mendeleev’s periodic table had some blank spaces for undiscovered elements

24. Scandium, gallium and germanium, discovered later, have properties similar to **Eka – boron, Eka–aluminium and Eka–silicon,** respectively.

25. The Mendellev's periodic table helped in correcting the atomic masses of some elements based on their positions in the table.

26. Atomic mass of beryllium was corrected from 13.5 to 9. With the help of this table, atomic masses of indium, gold, platinum etc., were corrected.]

27. Mendeleev fail to give fixed position to hydrogen in the Periodic Table. It was placed in group IA and group VI B.

28. Hydrogen resembled both the alkali metals and the halogens. So, it was placed above both the groups and could not be given a fixed position in Mendeleev's Periodic Table.

29. There is no place given for isotopes in Mendeleev's Periodic Table

30. Different isotopes of same elements have different atomic masses; therefore, each one of them should be given a different position in the periodic table. On the other hand, because they are chemically similar, they had to be given same position.

31. There are anomalous pairs of elements in Mendeleev's Periodic Table : At certain places, an element of higher atomic mass has been placed before an element of lower atomic mass. For example, Argon (39.91) is placed before potassium (39.1)

32. Disimilar elements placed together: Noble metals like Cu, Ag and Au are placed along with chemically dissimilar alkali metals in Group I . Similarly, Mn possessing very few similarities with halogens have been placed in VII group.

33. Similar elements separated: In Mendeleev's periodic table, certain chemically similar elements such as copper and mercury; gold and platinum have been placed in different groups.

34. Anomalous pairs : In the Mendeleev's Table based on atomic weight, the positions of certain pairs , e.g. Argon(at. wt = 39.94) and potassium (at. wt = 39.1) : Cobalt(at wt =58.93) and nickel (at wt = 58.71) ; Tellurium at wt = 127.60) and iodine (atomic weight = 126.90) would be reversed. In other words, certain pairs of elements are misfit in the periodic table, if atomic weight is the basis of classification.

35. The formulae for the oxides of the following elements: K, C, Al, Si, Ba. according to Mendeléev's Periodic Table are: K(potassium) belongs to group I. Thus, formula of its oxide is K_2O, similarly CO_2, Al_2O_3, SiO_2,, BaO.

36. The criteria used by Mendeleev in creating his periodic table are: (1) The chemical and physical properties of an element is the periodic function of its atomic mass.(ii) The elements were arranged in a period such that their properties changed from metallic to non-metallic.(iii) The elements were arranged in groups, such that all the elements have same, but graded physical and chemical properties.

37. The noble gases are placed in a separate group because (a) Noble gases are chemically inactive and hence constitute a separate group.(b)2. Noble gases as a group offer a perfect dividing line for starting a new period in the periodic table.

38. Moseley showed that the atomic number of an element is a more fundamental property. The Modern

Periodic Law can be stated as : 'Properties of elements are a periodic function of their atomic number.'

39. The Modern Periodic Table has 18 vertical columns known as 'groups' and 7 horizontal rows known as 'periods'.

40. The elements present in any one group have the same number of valence electrons. The number of electrons in the valence shell determines the group of the element. If the element has 1 or 2 electrons, then it belongs to group 1 or 2, respectively. If the element has 3 to 8 electrons, then its group is equal to 10 + number of valence electrons.

41. Elements with the same number of occupied shells are placed in the same period. For example, if an element has 4 electron shells, it belongs to the 4th period.

42. The atomic size depends on the distance between the centre of the nucleus and the outermost shell of an isolated atom.

43. The atomic radius decreases in moving from left to right along a period. This is due to an increase in nuclear charge (increase in no. of proton without increasing shell) which tends to pull the electrons closer to the nucleus and reduces the size of the atom.

44. The atomic size increases down the group. This is because new shells are being added as we go down the group. This increases the distance between the outermost electrons and the nucleus so that the atomic size increases in spite of the increase in nuclear charge.

45. The valencies of all elements of the same group are the same. The valence of an element with respect to oxygen is equal to its group number.

46. The melting points and boiling points decrease while moving down in group of metals.

47. The melting points and boiling points increases while moving down in group of non-metals.

48. Metallic character of the element decreases along a period because the effective nuclear charge acting on the valence shell electrons increases due to decrease in atomic size.

49. Metallic character of the element Increases while moving down in group because the effective nuclear charge experienced by valence electrons is decreasing as the outermost electrons are farther away from the nucleus(due to increase in atomic size).

50. Metals tend to lose electrons while forming bonds. That is why they are electropositive in nature.

51. Non-metals are electronegative as they tend to form bonds by gaining electrons.

52. The tendency to gain electrons increases in a period due to decrease in atomic size.

53. The tendency to lose electrons increases in a group due to increase in atomic size

54. Non metallic character decreases down in group because of decrease in tendency to gain electron which is due to increase in atomic size.

55. Non metallic character increases left to right in group because of increase in tendency to gain electron which is due to decrease in atomic size.

Periodic properties	Left to right in period	Down a group
Atomic size	Decreasing	Increasing
Tendency to lose Electron	Decreasing	Increasing
Tendency to gain Electron	Increasing	Decreasing
Metallic Character	Decreasing	Increasing
Non - metallic Character	Increasing	Decreasing
Distance b/w Valance Electron and Nucleus	Decreasing	Increasing
Force of attraction b/w Valance Electron and Nucleus	Increasing	Decreasing

56. Alkali Metals: Lithium, sodium, potassium, rubidium, caesium and francium have one electron in the valence shell. They are called alkali metals because their hydroxides are strong alkalis.

57. Halogens: The elements placed in group 7 (VIIA) and have seven electrons in their valence shell and so are mononvalent.All these elements form salts called halides, e.g. NaCl, NaI, KCl, KI etc. Halogen is an ancient Greek word meaning 'salt producer.

58. Transition Elements: Elements belonging to 3 to 12 groups are called transition elements. They are called transition elements because they are placed between the most reactive metals on the left and non-metals on the right.

59. Inner-transition Elements: The 6th period consists of elements that have atomic numbers 58 to 71. They are called Lanthanides. The 7th period consists of elements that have atomic numbers 90 to 105. They are called Actinides. Both of them are called inner transition elements.

60. The group VIA elements are called chalcogens because most ores of copper (Greek chalkos) are oxides or sulfides, and such ores contain traces of selenium and tellurium.