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Periodic Classification of Elements.

Doberliner's Triads.

When elements are arranged in the order of increasing atomic masses groups of three elements, having similar chemical Properties are obtained. The atomic mass of middle element of the triad being equal to the arithmetic mean of the atomic mass of the other two elements

Ex 1.

Elements of triad	Symbols	Atomic Mass.
1. Lithium	Li	7
2. Sodium	Na	23
3. Potassium	K	39

Atomic mass of Li = 7

" " of K = 39

A.M of Li and K = $\frac{7+39}{2}$

$= \frac{46}{2} = 23$

Actual Atomic mass of Na = 23.

2.

Elements of triad	Symbols	Atomic mass.
1. Calcium	Ca	40
2. Strontium	Sr	88
3. Barium	Ba	137

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3.

Elements of triad	Symbols	Atomic mass
1. Chlorine	Cl	35.5
2. Bromine	Br	80
3. Iodine	I	127

Limitations.

: He fail to arrange all then known elements in form of triads of elements having similar chemical Properties.
He could only identify only three triads from the elements known at that time, So his classification of elements was not much successful.

NEWLAND'S LAW of OCTAVES

When elements are arranged in order of increasing atomic masses, properties of the eight element (starting from a given element) are a repetition of the properties of the first element.

Ex

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	-	-

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Limitations:

1. Newland's law of octaves was applicable to the classification of elements up to calcium only.
2. He assumed that only 56 elements existed in nature and no more elements would be discovered in future.
3. In order to fit elements into his table, he put even two elements together in one slot and that too in coulumn of unlike elements having very different properties. Ex - Co, Ni etc.
4. Iron element (Fe) which resembles cobalt and nickel element in properties, was placed far away from these elements.

MENDELEEV'S PERIODIC TABLE.

The Properties of elements are in periodic function of their atomic masses.

Merits of Mendeleev's Classification of Elements

1. Mendeleev's periodic law predicted the existence of some elements that had not been discovered at that time.
2. Mendeleev's periodic Table could predict the Properties of several elements on basis of their Positions in Periodic Table.

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The Predicted and Actual Properties of Gallium.

	Property	Eka-al (Predict)	Gallium (Actual)
1.	Atomic mass	68	69.7
2	Density	5.9 g/cm$_3$	5.94 g/cm$_3$
3.	Melting Point	Low	30.2°C (low)
4.	Formula of chloride	$EaCl_3$	$GaCl_3$
5	Formula of oxide	Ea_2O_3	Ga_2O_3

3. Mendleev's periodic table could accommodate noble gases when they were discovered.

MODERN PERIODIC TABLE

Periodic Table was designed by Neil Bohr.

Ist group = alkali metal
IInd group = alkaline t
11 group = halogen family
10 group = noble element or inert gas

Groups = Tell about electron and valence electron.

Periods = Tell about no. of shells

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MODERN PERIODIC TABLE

Characteristics of Groups.

1. Outermost electrons :-
On going down the grow in the Periodic Table ~~than~~ have the same no. of valence of electrons

Ex

Symbol	Atomic No.	Electronic	confrigation
Li	3	2,1	1
Na	11	2,8,1	1
K	19	2,8,8,1	1

Valency.
By going a down in periodic table, all the elements in a group have the same valency.

Symbol	At No.	El. cof.	Valency.
Li	3	2,1	1
Na	11	2,8,1	1
K	19	2,8,8,1	1

3 Atomic size :
Atomic radius: The minimum distance b/w centre of nucleus to the outermost shell. By going on a down in periodic table, the atomic size of element will inc. or progressive inc. the no. of shell.

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MODERN PERIODIC TABLE

Groups: 1 I A | 2 II A | 3 III B | 4 IV B | 5 V B | 6 VI B | 7 VII B | 8 9 VIII | 10 | 11 I B | 12 II B | 13 III A | 14 IV A | 15 V A | 16 VI A | 17 VII A | 18 0

Periods: 1 | 2 | 3 | 4 | 5 | 6 | 7

MOST COMMON STRUCTURE
- CUBIC
- HEXAGONAL
- CUBIC: face centered
- RHOMBOHEDRAL
- CUBIC: body centered
- MONOCLINIC
- TETRAGONAL
- ORTHORHOMBIC

Fe Solids
He Gases
Ga Liquids
Pu Synthetic

INDEX
- Atomic Number
- Element Symbol
- Density @ 293k (g/cm³)
- Crystal Structure
- Name
- Atomic Weight (amu)
- Melting Point (°C)
- Boiling Point (°C)
- Electronegativity
- First Ionization Energy (kJ/mole)
- Atomic Radius (pm)
- Year of Discovery
- Oxidation States
- Electron Structure

Metals: Alkali Metals; Alkali Earth Metals; Inner-Transition: Lanthanides, Actinides; Transition Metals; Metals; Metalloids; Non metals; Halogens; Noble Gases; Transactinides

Non metals

\# Radioactive elements
* Indicates most stable Isotope

57-71 Lanthanides

89-103 Actinides

LANTHANIDES
This group of elements are known as Lanthanides (Rare Earth elements). The elements are closely related as the 14 electrons are successively added to 4f orbitals. Though the leading element Lanthanum does not have 4f orbitals its properties are characteristic of the elements of the group. The elements generally exhibit strong electropositive ionic state in M + 3 form. The chemical properties of the Lanthanides are exhibited by the decreasing ionic size which is popularly known as "Lanthanide contraction".

ACTINIDES
All the elements of this group are radioactive. Similar to Lanthanides electrons are added, but with more complex order, in 5f orbitals. For these elements the energy levels in the outer 5f orbitals are very close to each other. Though the Actinide have +3 as the principal valency, they also exhibit different ionic states from +3 to +6.

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Ex · Symbol At No. Ele-conf. Atomic size

Li 3 2,1

Na 11 2,8,1

K 19 2,8,8,1

chemical reactivity :-

Metal · On moving down in group the chemical reactivity of Metals will inc because the tendency to lose the electron will Inc.

Ex - Metal

H
Na
IC

↓ Inc.

Non-metal · On moving down in group the chemical reactivity of non-metal will dec. because the tendancy to gain the electron will dec.

Ex: Non-metal

F
Cl
Br ↓ decreases.

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Nature oxide - On moving down in group their is no change in nature of oxide.
Eg - Li, Na, K (basic)

Characteristics of Periods:
- Outermost electrons:
When we move from left to right in P.T. the valence electrons of elements will inc. from 1 to 8.

Ex

Symbol	Na	Mg	Al	Si	Ps	Cl	Ar
Atomic no.	11	12	13	14	15	16	17
Ele. Conf	2,8,1	2,8,2	2,8,3	2,8,4	2,85,	2,8,6	, 287
Valence electron	1	2	3	4	5	6	7

Valency :- when we move from left to right in Periodic Table the valency of elec. will inc. from 1 to 4 and then dec from 3 to 0.

Symbol	Na	Mg	Al	Si	Ps	Cl	Ar
Atomic No.	11	13	14	15	16	17	18
Elec. Conf.	2, 8, 1	2,8,2	2,8,3	2,8,4	2,8,5	2,8,6	2,8,7
Valency	1	2	3	4	5	6	7

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Atomic Size :-
When we from left to right in Periodic Table then the Atomic Size will dec. because in the same shell No. of e⁻ will inc due to which the Nucleaus charge will inc. and attraction b/w Nucleus and outermost will inc. Hence the size will dec.

Ex:

Na Mg Al Si P S Cl Ar

decreases →

chemical reactivity:
Metals → when we move from left to right in the Periodic table then the chemical reactivity of metals will dec because the tendency to lose the electron decreases

ex

Na Mg Al Si

decreases →

Non-metal → when we move from left to right in the periodic table the chemical reactivity of non-metal will inc. because the tendency To gain the electron will inc.

Eu

P S Cl

inc →

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Nature of oxide:-

When we move from left to right in periodic Table the basic nature of oxides decreases and the acidic nature of oxides will increased.

Ex. Na Mg Al Si P S Cl

Na Mg — basic oxide

Al Si — amphoteric oxide

P S Cl — acidic oxide

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Assignment - 1

Ques 1 (a) On what basis did Mendeleev arrange the elements in Periodic Table?

Ans Atomic masses

(b) On what basis they are arranged now?

Ans Atomic numbers

Ques 2 State wheather the following statements are true or false.

(a) Newland's divided the elements into horizontal rows of eight elements each.

Ans False

(b) According to Mendeleev's periodic law, the properties of element are a periodic function of their atomic numbers.

Ans False

(c) The elements in a group have consecutive atomic numbers.

Ans False

Ques 3 Name the Russian Chemist who said that the properties of elements are periodic function of their atomic masses.

Ans Mendeleev

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es 4. Rewrite the following statements after correction, if necessary:-

(a) Groups have elements with consecutive atomic no?

Ans Periods have elements with consecutive atomic numbers

(B) Periods are the horizontal rows of element

Ans Correct

(C) Isotopes are the elements of same group.

Ans Correct

Ques 5. Name the Scientists who gave the following laws in the early classification of elements:

(a) Law of Octaves

⇒ Newlands

(b) Law of triads

⇒ Dobereiner

Ques 6 A, B and C are the elements of a Dobereiner's triad If the atomic mass of A is 7 and that of C is 39, what should be the atomic mass of B?

Ans 23.

Ques 7 X and Y are the two elements having similar properties which obey Newland's Law Of Octaves How many elements are in b/w X & Y?

Ans 6 Element

Ques 8 What was the Mendleev's basis for the classificat, elem

Ans Atomic mass.

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Assignment - 2

Ques-1 Given alongside is a Pair of Periodic Table. As we move horizontally left to right

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

(i) what happens to the metallic character of elements?

Ans Decreases

(ii) what happens to atomic size?

Ans Decreases

Ques-2 How would the tendency to gain electrons change on moving from left to right in a Periodic table?

Ans: Decrease

Ques 3 How would the tendency to electrons change as we go from left to right across a period of the periodic table?

Ans. Decrease

Ques 4. (a) How does the chemical reactivity of alkali metals vary on going down in group 1 of Periodic Table?

Ans Increase

(b) How does the chemical reactivity of halogens on going down group 17 of Periodic Table?

Decrease

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Ques 5 What property do all elements in same coulumn of periodic table as boron have in common?

Ans Same valency and valence 3 in last shell.

Ques 6 What property do all elements in same groups of periodic table as fluorine have in common?

Ans Same valency and valence in last shell.

Ques 7 (a) What is the no. of valence electrons in the atoms of the first element in Period?

Ans One electron

(b) What is the usual no of valence electrons in atoms of last element in a Period?

Ans Right electron

Ques 8 State whether ~~the~~ false or True.

(a) On going down in a group of the periodic table the number of valence electrons increases

Ans False

Ques 9 What is the major characteristic of first elements in periods of Periodic table? What is general name of such element?

Ans The ~~first element~~ in period all has valence electron the general name of element is Hydrogen

Ques 10 How do the atomic radii of element change as we go from left to right in period of Periodic Table?

Ans 13/7

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Ques 11 What happens to metallic character of the elements are we go down in group of P.T?

Ans. Metallic character decreases

Ques 12 How does the no. of valence electrons vary on moving from left to right.

(i) in the first period of periodic Table?

8.

(ii) In the second period of period Table?

1.

Ques 13. How does the valency of elements ~~vary in~~ change on moving from left to right in the third period of Periodic Table?

Ans. N/C.

Ques 14 How does the valency of electron vary in going down a group of Periodic Table?

Ans. Same in it

Ques 15 Name the element which is in:

(A) first group and third Period.

Sodium

(B) Seventeenth group and second Period.

Flaorine

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Ques 16 How do electronic configration of element change in second period of P.T. with inc. in atomic no.?

Ans: 2, 1; 2 2; 2, 3; 2, 4; 2; 5; 2, 6; 2, 7; 2; 8

Ques 17 Arrange the following elements in inc order of their atomic radii?

Li, Be, F, N

Ans F < N < Be < Li

Ques 18 Arrange the following elements in the inc order of their metallic character.

Mg, Ca, K, Ga

Ans Ga < Mg < Ca < K.