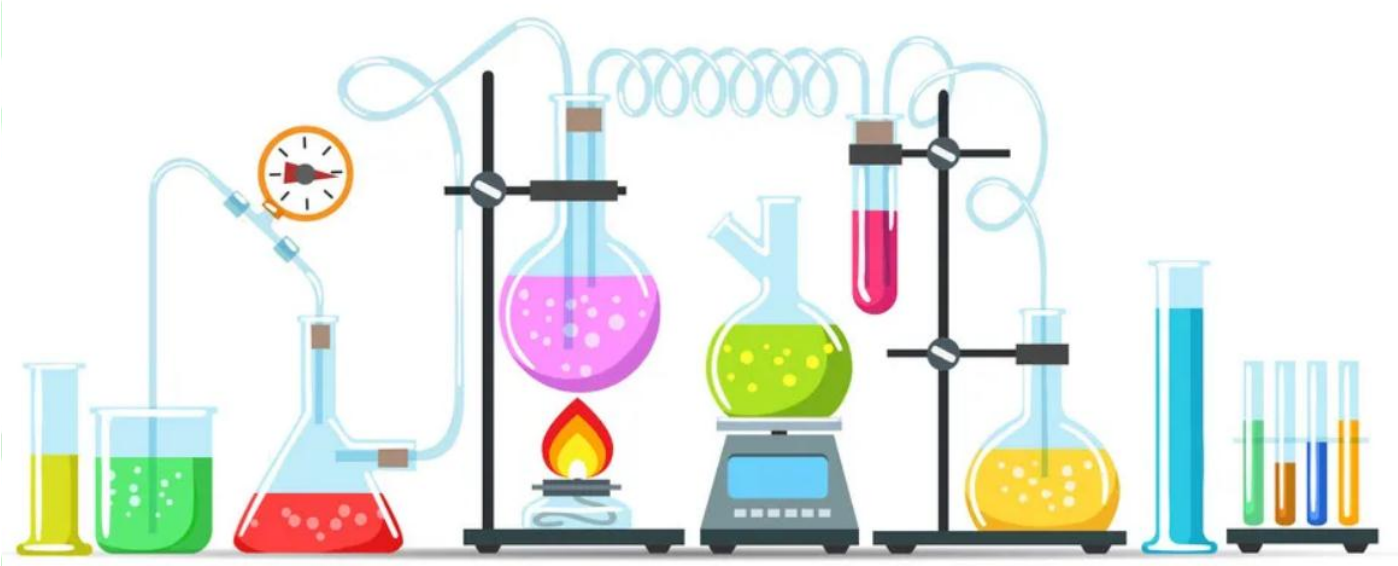
SCIENCE

(Chemistry)

Chapter 5: Periodic Classification of Elements



Periodic Classification of Elements

Early Attempts of Classification of Elements

- Matter around us is present in the form of elements, compounds and mixtures.
- Elements are substances containing atoms of only one type. E.g., Na, Mg, Au, etc.
- There are 118 elements known to us. All these have different properties.
- To make the study of these elements easy, these elements have been divided into few groups in such a way that elements in the same group have similar properties.

Dobereiner's Triads

Law of Triads: When elements are arranged in the order of their increasing atomic masses, the atomic mass of the middle element was approximately the mean of the atomic masses of the other two elements.

Dobereiner arranged a group of three elements with similar properties in the order of increasing atomic masses and called it a triad. He showed that the atomic mass of the middle element is approximately the arithmetic mean of the other two. But, Dobereiner could identify only the following three triads from the elements known at that time.

For example:

Consider the triad of lithium, sodium and potassium. The atomic mass of sodium is the mean of the atomic masses of lithium and potassium.

Element	Atomic Mass	Average
Lithium	6.9	Atomic mass of Na$= \frac{6.9+39}{2} = 23$
Sodium	23	
Potassium	39	

Newlands' Law of Octaves

- **Law of Octaves:** When elements are arranged in the increasing order of their atomic masses, the properties of every eighth element is similar to the first.

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	F
Cl	K	Ca	Cr	Ti	Mn	Fe
Co and Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce and La	Zr	_____	_____

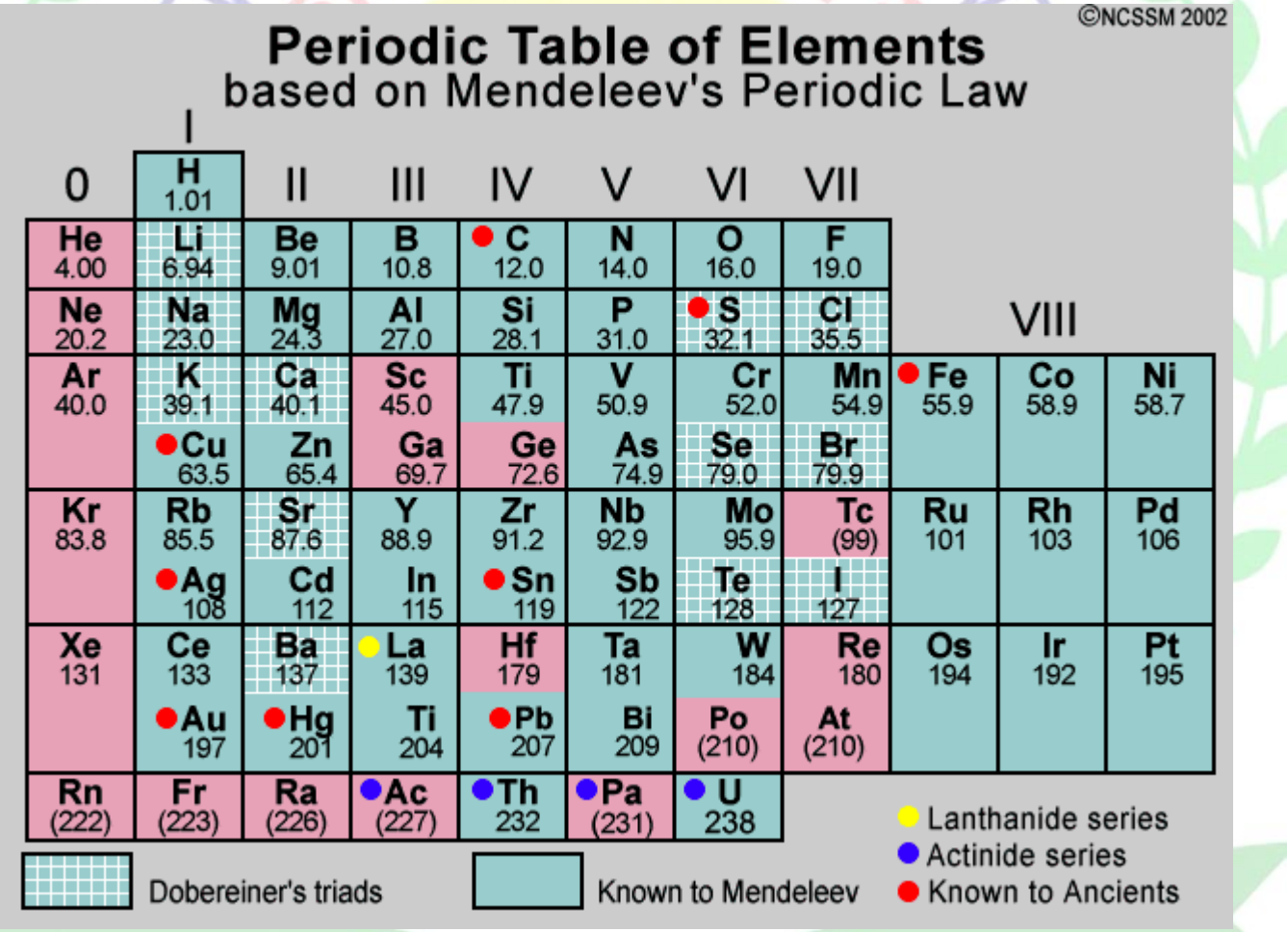
Limitations

- Newland could arrange elements only up to calcium, out of the total 56 elements known.

- After calcium, every eighth element did not possess properties similar to that of the first.
- Only 56 elements were known at the time of Newland, but later several new elements were discovered.
- In order to fit the existing element arrangement, Newland placed two elements in the same position which differed in their properties.

  For example: Iron, an element which resembles cobalt and nickel in its properties is placed far away from these elements.
- The periodic table did not include inert gases because they were not discovered then.

Mendeleev's Periodic Table



Mendeleev's Periodic Law: The physical and chemical properties of elements are a periodic function of their atomic masses.

Achievements of Mendeleev's Periodic Table:

- Systematic Study of Elements – The table provided the arrangements of elements showing similar properties into groups. This was very useful in studying and remembering the properties of a large number of elements in a systematic way.
- Prediction of New Elements – Mendeleev had predicted new elements and had left three blanks for these undiscovered elements. He was able to predict their properties more or less accurately. He named them eka-boron, eka-aluminium and eka-silicon.

- Correction of Atomic Masses - Based on the elements' positions in the periodic table, Mendeleev was able to correct their atomic masses. The atomic mass of beryllium was corrected from 13.5 to 9.0.

Features of Mendeleev's Periodic Table

- There are seven horizontal rows in the periodic table, numbered from 1 to 7. These seven rows are called periods.
- There are eight vertical columns numbered from I to VIII. These eight columns are called groups. Groups I to VII are further divided into sub groups A and B.
- The properties of elements in a particular period show regular gradation from left to right.

Merits of Mendeleev's Periodic Table

- Mendeleev kept some blank spaces in the periodic table for the elements which were yet to be discovered.

Predicted element	Actual element discovered later
Eka-boron	Scandium
Eka-aluminium	Gallium
Eka-silicon	Germanium

- He also predicted properties of some elements even before their discovery which were later found to be correct.

Property	Eka-aluminium	Gallium
Atomic mass	68	69.7
Formula of oxide	E_2O_3	Ga_2O_3
Formula of chloride	ECl_3	$GaCl_3$

- Mendeleev's periodic table could accommodate noble gases when they were discovered.

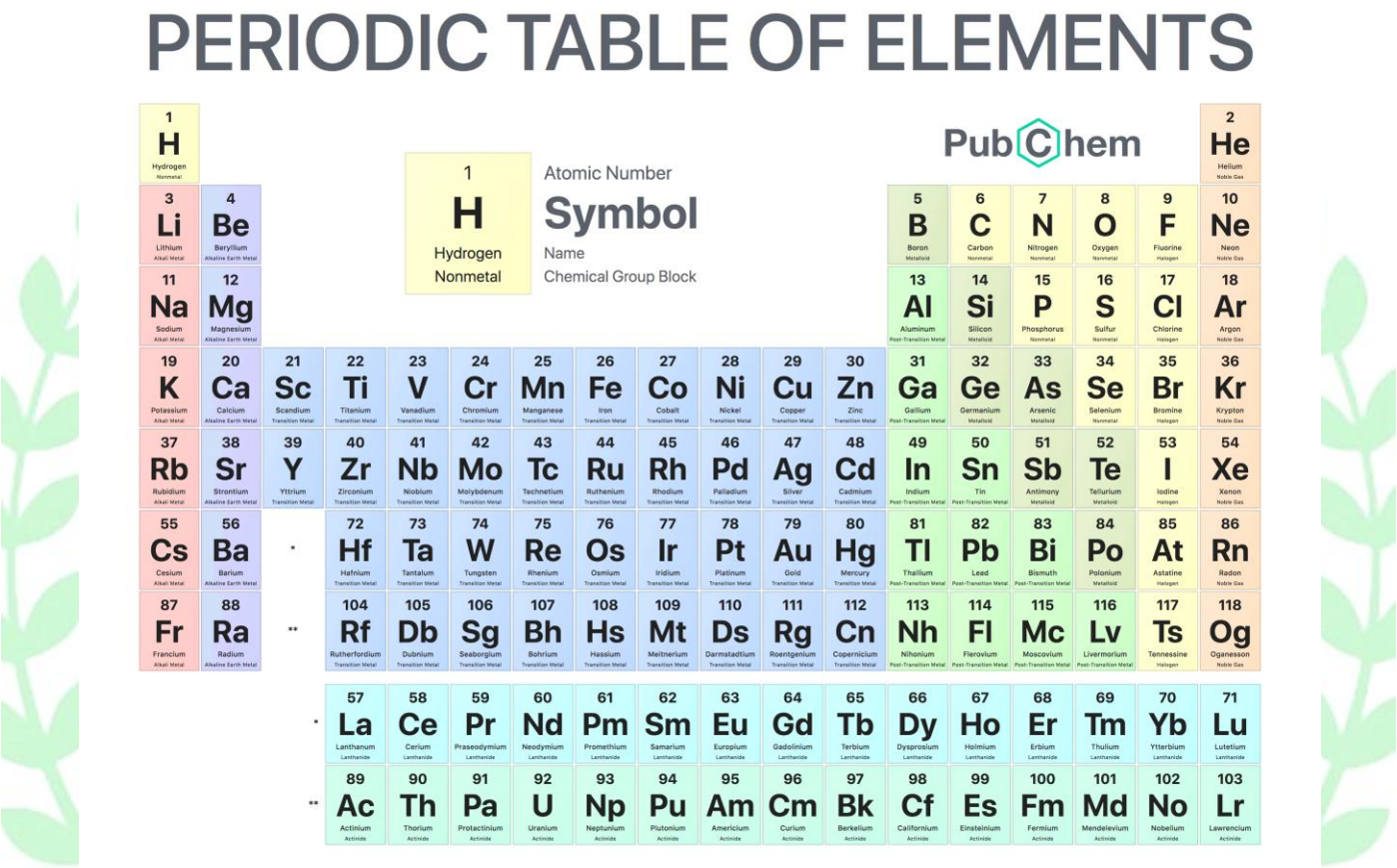
Demerits of Mendeleev's Periodic Table

- Hydrogen resembles alkali metals as well as halogens. So, a correct position could not be assigned to hydrogen in the periodic table.
- The position of isotopes could not be explained. Isotopes are atoms of the same element having similar chemical properties but different atomic masses. If the elements are arranged according to atomic masses, the isotopes should be placed in different groups of the periodic table.
- At certain places, an element of higher atomic mass was placed before an element of lower atomic mass.
- For example: Cobalt (Co = 58.93) was placed before nickel (Ni = 58.71).

- Some elements placed in the same sub group had different properties.

For example: Manganese is placed with the halogens which are totally different in their properties.

Modern Periodic Table



- In the year 1913, an English physicist named Henry Mosely found that the atomic number of an element, which was denoted by the symbol 'Z' was a more basic property to group them instead of their atomic masses. Thus Mendeleev's periodic table was modified for the same. The elements were now grouped based on the increasing atomic number.
- This came to be known as the **Modern Periodic Law** and it states, 'properties of the elements are a periodic function of their atomic number'. Hence the new classification of the elements based on this came into existence and was termed as 'Modern Periodic Table.
- With this system of grouping, it was easy to predict the properties of the elements when they were arranged in the order of increasing atomic numbers. It is to be noted that the periodicity of the elements is based on the electronic configuration or the number of protons in the nucleus.

Position of Elements in the Periodic Table

Periods

- The horizontal rows in the Modern Periodic Table are called periods.
- There are 7 periods in this table. The periods have the same elements that have the

same valence shell or the energy shell. Example - Na, Mg, Al, Si, P, S, Cl are placed in the same shell as they have the electronic shells as K, L and M.

- In a period, the number of electrons present in the energy shells increases by 1 on moving from left to right within a period. Example - Na - 1, Mg - 2, Al - 3, and so on.
- The number of elements present in a period can be determined by the formula $2n^2$, where n is the number of the shell from the nucleus.
- The first period consists of two elements only namely, hydrogen and helium as they have only 1 valence shell. Example - hydrogen (Z = 1 or shell as K = 1), helium (Z = 2 or shell as K = 2)
- The second period has 8 elements with 2 shells and it starts with lithium (Z = 3 or shells as K = 2, L = 1) and ends with neon (Z = 10 or shells as K = 2, L = 8).
- The third period has 8 elements with 3 shells and it starts with sodium (Z = 11 or shells as K = 2, L = 8, M = 1) and ends with argon (Z = 18 or shells as K = 2, L = 8, M = 8).
- Similarly, the fourth period has 18 elements with 4 shells and starts with potassium (Z = 19) and ends with krypton (Z = 36).
- The fifth period having 18 elements with 5 shells starts with rubidium (Z = 37) and ends with xenon (Z = 54).
- The sixth period with 32 elements has 6 shells and it starts with caesium (Z = 55) ending with radon (Z = 86).
- The seventh and last period is incomplete with 19 elements starts francium (Z = 87) and going on till oganesson (Z = 118).

Groups

- The vertical columns are called groups and consist of eighteen groups numbered from 1 to 18.
  - Group 1 elements are known as alkali metals.
  - Group 2 elements are known as alkaline earth metals.
  - Group 15 elements are known as pnicogens.
  - Group 16 elements are known as chalcogens.
  - Group 17 elements are known as halogens.
  - Group 18 elements are known as noble gases.
- Elements having the same number of valence electrons are present in the same group.
- Elements present in the same group show the same chemical properties.

Blocks

The periodic table is also divided into 4 blocks that are based on the subshell of the valence electrons. They are:

- **s-Block elements:** All the elements of group 1 and 2 are included in this block and their general electronic configuration is ns^{1-2} Example - Hydrogen (H), Sodium (Na), etc from group 1 and Magnesium (Mg), Calcium (Ca), etc from group 2.
- **p-Block elements:** This includes the elements from group 13 to 18. They have an electronic configuration as ns^2np^{1-6}.
- **d-block elements:** This includes group 3 to 12 elements. They have a general electronic configuration as $(n-1)d^{1-10}ns^{1-2}$.
- **f-block elements:** This block has sets of elements, lanthanides and the actinides. They have the electronic configuration of $(n-2)f^{1-14}(n-1)^{d0-1}ns^2$. The lanthanides starts from Lanthanum (La) - Lutetium (Lu) and the actinides starts from Actinium (Ac) - Lawrencium (Lr).

Trends in the Modern Periodic Table

Valency

- The valency of an element is determined by the number of valence electrons present in its outermost shell.
- In a group, all the elements have the same number of valence electrons.
- On moving from left to right in each short period, the valency increases from 1 to 4 and then decreases to zero.

Atomic Size

- Atomic size refers to the radius of the atom.
- It is the distance between the centre of the nucleus and the outermost shell of an isolated atom.
- In a period, the atomic radius decreases from left to right. This is because electrons are added to the same shell and so they experience a greater pull from the nucleus.
- Moving in a group from top to bottom, the atomic radius increases as new shells are added, resulting in the outermost electrons being farther away from the nucleus.

Metallic & Non-metallic Properties

- Metals show a tendency to lose electrons and are said to be electropositive.
- Non-metals show a tendency to accept or share electrons and are said to be electronegative.
- Moving from left to right in a period, the metallic character decreases and the non-metallic character increases. The atomic size decreases and so electrons are not released easily.
- In a group, the metallic character increases from top to bottom and the non-metallic character decreases. This is because, as the atomic size increases the valence electrons can be easily removed.

- Elements on the left of the periodic table are all metals and on the right of the periodic table are all non-metals.
- A zigzag line in the periodic table separates the metals from non-metals. The borderline elements show intermediate properties and are called metalloids.

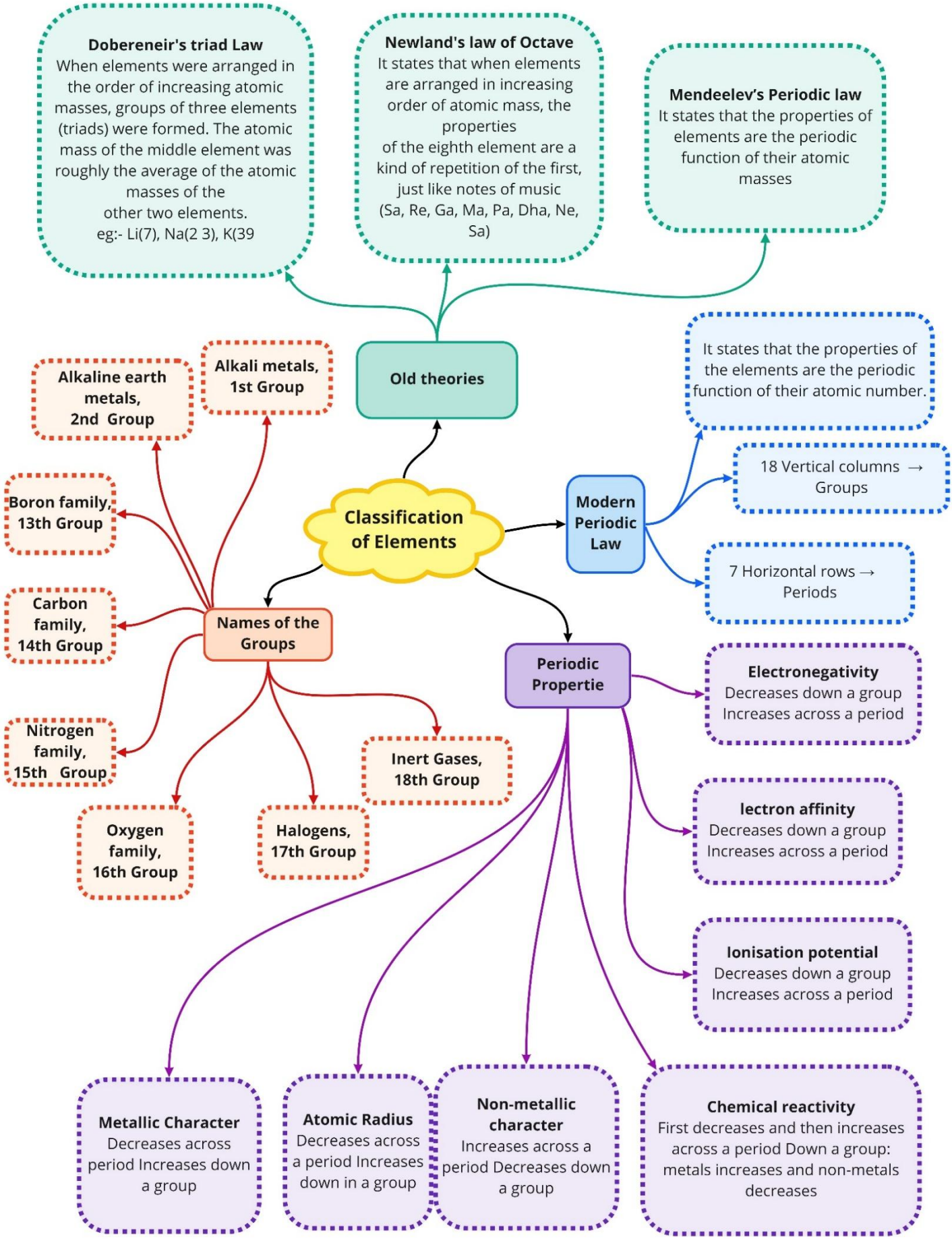
Periodic Table of the Elements

1 1IA 11A	2 IIA 2A	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8	9 VIII 8	10	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 1.0079																	2 He Helium 4.00260
3 Li Lithium 6.941	4 Be Beryllium 9.01218											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.998403	10 Ne Neon 20.1797
11 Na Sodium 22.989768	12 Mg Magnesium 24.305											13 Al Aluminum 26.981539	14 Si Silicon 28.0855	15 P Phosphorus 30.973762	16 S Sulfur 32.066	17 Cl Chlorine 35.4527	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.95591	22 Ti Titanium 47.88	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938	26 Fe Iron 55.847	27 Co Cobalt 58.9332	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.732	32 Ge Germanium 72.64	33 As Arsenic 74.92159	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium 98.9072	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.9055	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.90447	54 Xe Xenon 131.29
55 Cs Cesium 132.90543	56 Ba Barium 137.327	57-71	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.9665	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98037	84 Po Polonium [208.9824]	85 At Astatine 209.9871	86 Rn Radon 222.0176
87 Fr Francium 223.0197	88 Ra Radium 226.0254	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 138.9055	58 Ce Cerium 140.115	59 Pr Praseodymium 140.90765	60 Nd Neodymium 144.24	61 Pm Promethium 144.9127	62 Sm Samarium 150.36	63 Eu Europium 151.9655	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92534	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93032	68 Er Erbium 167.26	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
Actinide Series	89 Ac Actinium 227.0278	90 Th Thorium 232.0381	91 Pa Protactinium 231.03588	92 U Uranium 238.0289	93 Np Neptunium 237.0482	94 Pu Plutonium 244.0642	95 Am Americium 243.0614	96 Cm Curium 247.0703	97 Bk Berkelium 247.0703	98 Cf Californium 251.0796	99 Es Einsteinium [254]	100 Fm Fermium 257.0951	101 Md Mendelevium 258.1	102 No Nobelium 259.1009	103 Lr Lawrencium [262]

Alkali Metals | Alkaline Earths | Transition Metals | Basic Metals | Semi-Metals | Nonmetals | Halogens | Noble Gases | Lanthanides | Actinides

Class : 10th Chemistry
CHAPTER : 5 Classification of Elements



Important Questions

➢ Multiple Choice Questions:

1. Newlands relation is called.

(a) Musical Law

(b) Law of Octaves

(c) Periodic Law

(d) Atomic Mass Law

2. Upto which element, the Law of Octaves was found applicable?

(a) Oxygen

(b) Calcium

(c) Cobalt

(d) Potassium

3. In Mendeleev's Periodic Table, gaps were left for the elements to be discovered later. Which of the following elements found a place in the Periodic Table later?

(a) Chlorine

(b) Silicon

(c) Oxygen

(d) Germanium

4. At the time of Mendeleev, the number of elements known was

(a) 63

(b) 65

(c) 62

(d) 64

5. The properties of eka-aluminium predicted by Mendeleev are the same as the properties of later discovered element:

(a) Scandium

(b) Germanium

(c) Gallium

(d) Aluminium

6. An atom of an element has the electronic configuration 2,8,2. To which group does it belong?

(a) 4th group

(b) 6th group

(c) 3rd group

(d) 2nd group

7. The arrangement of elements in the Modem Periodic Table is based on their

(a) increasing atomic mass in the period

(b) increasing atomic number in the horizontal rows

(c) increasing atomic number in the vertical columns

(d) increasing atomic mass in the group

8. Where would you locate the element with electronic configuration 2, 8 in the Modern Periodic Table?

(a) Group 8

(b) Group 2

(c) Group 18

(d) Group 10

9. Element 'X' forms a chloride with the formula XCl_2, which is a solid with high melting point. X would most likely be in the same group of the periodic table as:

(a) Si

(b) Mg

(c) Al

(d) Na

10. Which of these belong to the same period?

Element	A	B	C
Atomic number	2	10	5

(a) A, B

(b) B, C

(c) C, A

(d) A, B and C

➢ Very Short Question:

1. Indicate the elements which belong to the same group from their atomic numbers as 9, 17, 24, 30, 35, 45.

2. Arrange the following in decreasing atomic size:

(i) Na, Mg, K

(ii) N, F, O

(iii) N, S, P

3. Give the name and electronic configuration of second alkali metal.

4. What is the similarity in the electronic configuration of Mg, Ca and Sr?

5. Name the members of alkaline earth family. Which out of them is radioactive in nature?

Answer: The members of alkaline earth family (group 2) are: Be, Mg, Ca, Sr, Ba, Ra. The last element radium (Ra) is radioactive in nature.

6. The two isotopes of chlorine have atomic mass 35 u and 37 u. Should they be placed in separate slots in the periodic table?

7. An element "X" has mass number 35 and number of neutrons is 18.

Identify group number and period of the element "X".

8. Flow does metallic character of the elements vary

(i) in a group

(ii) in a period?

9. Name three elements which behave as metalloids.

10. Which property do all the elements possess which are present in the same period as the element boron?

➢ Short Questions:

1. Identify the non-metals from the elements given below.

(a) 2, 8, 1

(b) 2, 8, 7

(c) 2, 8, 3

(d) 2, 8, 5.

2. Identify the elements X and Y from the following information.

(a) X has 17 protons and 18 neutrons

(b) Y has 17 protons and 20 neutrons.

3. Identify the elements from the following characteristics and arrange them in increasing order of metallic character.

(a) An element which imparts golden yellow colour to the flame.

(b) An element whose oxide is used as a white wash.

(c) An element which is constituent of chlorophyll i.e. green coloring matter in plants.

4. (a) Atomic numbers of Mg and Al are 12 and 13 respectively. "Write their electronic configuration.

(b) Mention the period of the Modern Periodic Table to which the above two elements belong. Give reason for your answer.

5. From the part of a periodic table, answer the following questions

1 Hydrogen	2	13	14 Carbon	15	16 Oxygen	17 Fluorine
X			P			Q
Y						R
Z						T

(a) Atomic number of oxygen is 8. What would be the atomic number of, Fluorine?

(b) Out of 'X' and 'Q' which element has larger atomic size? Give reason for your answer.

(c) Out of 'Y' and 'Z' which element has smaller atomic size? Give reason for your answer.

6. Calcium is an element with atomic number 20.

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

(ii) Will its size be more or smaller than that of potassium?

(iii) Write the formula of its chloride.

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

8. Given below are some of the elements of first group Li, Na, K

(Their atomic numbers are 3, 11, 19 respectively and they belong to 2nd, 3rd and 4th period respectively). Arrange these in the decreasing order of metallic character exhibited by them.

➢ Long Questions:

1. Three elements A, B and C have atomic numbers 7, 8 and 9 respectively.

(a) What would be their positions in the modern periodic table? (Mention group and period both)

(b) Arrange A, B and C in decreasing order of their size.

(c) Which one of the three elements is most reactive and why?

2. The elements with atomic number 3 to 10 belong to the second period. Taking into account the trends in the general periodic properties, predict.

(a) The most electronegative element

(b) The most electropositive element

(c) The element belonging to noble gas family

(d) The element which constitutes large number of organic compounds.

3. "Elements in Periodic Table show periodicity of properties". List any four properties.

➢ Assertion Reason Questions:

1. For two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:
   a. Both A and R are true, and R is correct explanation of the assertion.
   b. Both A and R are true, but R is not the correct explanation of the assertion.
   c. A is true, but R is false.
   d. A is false, but R is true.

Assertion: Atomic size of as is more than that of P.

Reason: Atomic size decreases along a period.

2. For two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:
   a. Both A and R are true, and R is correct explanation of the assertion.
   b. Both A and R are true, but R is not the correct explanation of the assertion.
   c. A is true, but R is false.
   d. A is false, but R is true.

Assertion: Chlorine is the most electronegative element of the halogen family.

Reason: Size of chlorine is more than that of fluorine.

1. Read the following and answer any four questions from (i) to (v).

"Properties of elements are the periodic function of their atomic numbers." This is known as modern periodic law. It means that the properties of elements depend on their atomic numbers, and the elements are given positions in the periodic table on the basis of their increasing atomic number. Atomic number determines the distribution of electrons in the orbit, and electrons of the outermost orbit determine the properties of an element. There are 18 groups (vertical columns) and 7 periods

(horizontal lines) in modem form of the periodic table. The number of the period is equal to the number of shells in the atoms of the elements belonging to that period.

i. What is the atomic number of elements of period 3 and group 17?
   a. 10
   b. 14
   c. 17
   d. 12

ii. Atomic number of an element is 2, 8, 6. Its period number and valency are respectively.
   a. 3, 2
   b. 6, 6
   c. 6, 2
   d. 2, 2

iii. An element has mass number 40 and contains 20 neutrons in its atom. To which period and group of the periodic table does it belong?
   a. Period-3, Group-3
   b. Period-4, Group-3
   c. Period-4, Group-2
   d. Period-4, Group-4

iv. An elements 'X' has an atomic number of 16. With which of the following elements will it show similar.
   a. Ne (10)
   b. N (7)
   c. O (8)
   d. Be (8)

v. Identify the statement(s) which is(are) true for the modern periodic table.
   a. It reflects trends in physical and chemical properties of the elements.
   b. It helps to reflect the relative atomicity of bonds between any two elements.
   c. It helps to predict the stable valency state of the elements.
   d. All of these.

2. Read the following and answer any four questions from (i) to (v).

   The recurrence of properties of the elements after a certain regular interval, when they are arranged in the increasing order of their atomic numbers, is called periodicity. There are a number of physical properties such as atomic size, metallic

and non-metallic character, etc. which show periodic variation. In periodic table, various properties vary differently from moving left to right in a period and going down in a group. In a period, properties vary because from moving left to right in a period, number of shells remain same, but valence electron increases by one number hence nuclear charge increases. In a group, ongoing down, number of valence shells increases while number of valence electrons remains same.

i. From top to bottom in a group of the periodic table, the electropositive character of the element.
   a. Increases.
   b. Decreases.
   c. Remains unchanged.
   d. Changes irregularly.

ii. Which element has the largest size in the second period?
   a. N
   b. F
   c. Li
   d. Be

iii. Which of the following elements has three valence electrons?
   a. Cs
   b. Ca
   c. Al
   d. S

iv. In the periodic table, the metallic character of elements.
   a. Decreases from left to right and decreases down the group.
   b. Decreases from left to right and increases down the group.
   c. Increases from left to right and increases down the group.
   d. Increases from left to right and decreases down the group.

v. Which of the following increases along the period?
   a. Number of valence electrons.
   b. Atomic size.
   c. Electropositive character.
   d. All of these.

Answer Key-

➢ Multiple Choice Answers:

1. (b) Law of Octaves
2. (b) Calcium
3. (d) Germanium
4. (a) 63
5. (c) Gallium
6. (d) 2nd group
7. (b) increasing atomic number in the horizontal rows
8. (c) Group 18
9. (b) Mg
10. (b) B, C

➢ Very Short Answers:

1. Answer: Elements with atomic numbers 9, 17 and 35 belong to the same group i.e., halogen family.
2. Answer:

   (i) K, Na, Mg

   (ii) N, O, F

   (iii) P, S, N.
3. Answer: The second alkali metal is sodium (Na). Its electronic configuration is 2, 8, 1.
4. Answer: All the elements belong to group 2 and have two electrons in their valence shell.
5. Answer: The members of alkaline earth family (group 2) are: Be, Mg, Ca, Sr, Ba, Ra. The last element radium (Ra) is radioactive in nature.
6. Answer: No, they should be placed in the same slot (or position) because the periodic table is based on the atomic numbers of the elements. Both the isotopes of the element chlorine have the same atomic number (Z = 17).
7. Answer:

   Atomic number of X = Mass No. – No. of neutrons = 35 – 17 = 18.

   Electronic configuration = 2, 8, 7;

   Group No. = 17, Period No. = 3.
8. Answer:

   (i) The metallic character of the elements increases downwards in a group.

   (ii) The metallic character of the elements decreases from left to the right along a period.

9. Answer: The elements are: arsenic (As), antimony (Sb) and germanium (Ge).
10. Answer: In all the elements, the last electron is present in the same shell i.e., L-shell or second shell.

➢ Short Answer:

1. Answer: The element chlorine (Cl) corresponding to configuration (b) and the element phosphorus (P) corresponding to configuration (d) are both non-metals.
2. Answer: Both the elements X and Y are the isotopes of the same element chlorine because they have the same number oi protons (17).

   Remember: Two different elements cannot have the same number of protons. Therefore, X and Y are the isotopes of the same element.
3. Answer:

   (a) Sodium

   (b) Calcium

   (c) Magnesium.

   Sodium (Na) belongs to group 1. Both calcium (Ca) and magnesium (Mg) are present in group 2. The element Ca is placed below Mg in the group. Since the metallic character of the elements decreases along a period and increases down the group, in the light of these observations, the increasing order of metallic character is: Mg < Na < Ca.
4. Answer:

   (a) The electronic configuration of the elements are

   Mg(Z = 12) 2, 8, 2 ;

   Al (Z = 13) 2, 8, 3.

   (b) Both these elements belong to third period since their atoms have three shells.
5. Answer:

   (a) Atomic number of Fluorine is (8 + 1) = 9.

   (b) Since the atomic size of the elements decreases along a period the element ‘Q’ has a smaller size than element ‘X’.

   (c) Since the atomic size of the elements increases down the group, the element ‘Y’ has a smaller size than element ‘Z’.
6. Answer:

   The electronic configuration of calcium (Z = 20) is 2, 8, 8, 2.

   (i) Since it has only two valence electrons, it is present in group 2. It is a metal.

   (ii) Both potassium (K) and calcium (Ca) are present in fourth period. Since atomic size decreases along a period, calcium is smaller in size.

   (iii) The valency of calcium is 2. The formula of its chloride is CaCl2.

7. Answer:

   Atomic number of the element 'X' = 35 – 18 = 17

   Electronic configuration of the element 'X' = 2, 8, 7

   Group number = 17;

   Period number = 3.

   Valency of the element 'X' = 8 – 7 = 1.

8. Answer: All the three elements belong to the group (1) of alkali metals. Since the metallic character of the elements increases down a group, the decreasing order of metallic character is K > Na > Li.

➢ Long Answer:

1. Answer:

   The electronic configuration of these elements are :

   (a) A (Z = 7) 2, 5;

   B (Z = 8) 2, 6;

   C (Z = 9) 2, 7

   Position of element A = 15th group and 2nd period

   Position of element B = 16th group and 2nd period '

   Position of element C = 17th group and 2nd period.

   (b) In general, atomic size decreases along a period. Therefore, decreasing order of size is A > B > C

   (c) The element C (Z = 9) is fluorine. It is the most reactive element since it needs only one electron to acquire a noble gas configuration.

2. Answer:

   (a) The most electronegative element has atomic number (Z) = 9. It is fluorine (F).

   (b) The most electropositive element has atomic number (Z) = 3. It is lithium (Li)

   (c) The element belonging to noble gas family has atomic number (Z) = 10. It is neon (Ne)

   (d) The element which constitutes large number of organic compounds has atomic number (Z) = 6. It is carbon (C).

3. Answer:

   Periodicity i.e., repetition of similar properties is shown by the elements present in a group and separated by definite gaps of atomic number. For example,

   Elements in a group have same number of valence electrons and same valency.

   Elements present in a group show similar chemical properties.

The atomic sizes of the elements in a group increase regularly.

The m.p. and b.p. of the elements in a group increase regularly.

➢ Assertion Reason Answer:

1. (b) Both A and R are true, but R is not the correct explanation of the assertion.

   Explanation:

   Atomic size increases down a group.

2. (d) A is false, but R is true.

   Explanation:

   Fluorine is most electronegative element of the halogen family.

➢ Case Study Questions:

1. i (c) 17

Explanation:

The element is chlorine (Z = 17).

ii. (a) 3, 2

Explanation:

The element (sulphur) belongs to third period and its valency is 2.

iii. (c) Period-4, Group-2

Explanation:

Atomic number of the element= 40- 20 = 20 Electronic configuration of the element is 2, 8, 8, 2; i.e., the element is calcium which belongs to 4th period and 2nd group of the periodic table.

iv. (c) O (8)

Explanation:

The element is sulphur. Sulphur and oxygen belong to group 16.

v. (d) All of these.

2. i (a) Increases.

Explanation:

As the size of the atom increases down the group, electropositive character increases.

ii. (c) Li

Explanation:

Li is the first element of the second period. As the size decreases in the period from left to right, therefore, Li is the largest atom in the period.

iii. (c) Al

Explanation:

Al (Z = 13): 2, 8, 3

iv. (b)

Explanation:

Metallic character of elements decreases from left to right and increases down the group.

v. (a) Number of valence electrons.

Explanation:

As we move from left to right along a period, the number of valence electrons increases from 1 to 8.