III. Long Answer Type Questions

Question 1. Discuss the main features of long form of the periodic table. What are the advantages of long . form of periodic table?
Answer:
Main features of long form of periodic table:

- Groups. The vertical columns in the periodic table are known as groups. There are 18 groups in the long form of periodic table.
  Each group having the same electronic configuration in the outermost shell.
- Periods. There are 7 periods in the long form of periodic table. It is denoted by n which means highest principal quantum number.
- Lanthanoids. Group of 14 elements in the sixth period. They are placed after Lanthanum.
- Actinides. Group of 14 elements in the seventh period after actinium. Both Lanthanoids and actinoids are placed in separate panel at the bottom of the periodic table.

Advantages of long form of periodic table:

- It gives a suitable link between the position of element and its electronic configuration.
- On the basis of atomic numbers it easier to remember all the elements.
- The elements in the same group have similar properties due to their outer-most (valence shell) configuration. Thus it gives is a logical classification.
- Justified positions are provided to transition and inner transition elements. '
- It makes the study of elements systematic and simple.

Question 2. Discuss the main characteristics of four blocks of elements in the periodic table? Give their general electronic configuration.
Answer:
s-block elements:

- They are highly reactive elements and thus occurs in combined state. On moving down the group their reactivity increases.
- They have good reducing characters.
- They generally form electropositive ion by losing 1 or 2 electrons, that's why they are electro positive in nature.
- They are good conductors of heat and electricity.

p-block elements:

- Most of the p-block elements show variable oxidation states.
- They include both metals and non-metals.
- They are generally covalent in nature.
- As move from left to right the non-metallic character of the element increases.
- On moving down the group metallic character increases.

d-block elements:

- d-block elements show variable oxidation states.
- They are generally paramagnetic in nature.
- Their compounds are generally coloured. Those which form complex compounds.
- Most of the elements and their compounds acts as catalyst.

f-block elements:

- They are generally heavy metals having high melting and boiling points.
- Their compounds are generally coloured.
- Variable oxidation states are generally shown by these elements.
- Most of Activities are radioactive.

General electronic configuration:
s-block —$ns^{1-2}$
p-block —$ns^2\ np^{1-6}$
d-block —$(n-1)\ d^{1-10}\ ns^{0-2}$
f-block —$(n-2)f^{0-14}\ (n-1)\ d^{0-1}\ ns^2$

Question 3. Define electron gain enthalpy. What are its units? Discuss the factors which influence the electron gain enthalpy.
Answer: Electron gain enthalpy is the energy released when an isolated gaseous atom is converted into a negative ion by adding an extra electron.
Electron gain enthalpy is denoted by the sign $\Delta_{eg}H$.
The process may be represented by
$M(g) + e^- \rightarrow M^-(g)$
$\Delta H = \Delta_{eg} H$
electron gain enthalpy is negative or positive it depends upon the nature of the element. For example. For halogens it is highly negative, because they can acquire the noble gas configuration by accepting an extra electron.
In contrast. For noble gases have positive electron gain enthalpy because energy has to be supplied to the element.
Factors on which electron gain enthalpy depends:

1. Atomic size. As the size of an atom increases, the distance between its nucleus and the incoming electron also increases. Therefore, the force of attraction between the nucleus and the incoming electron decreases and hence the electron gain enthalpy becomes less negative.
2. Nuclear charge. As the nuclear charge increases force of attraction for the incoming electron increases and thus electron gain enthalpy becomes more negative.
3. Symmetry of electronic configuration. Elements having symmetrical configuration (Either half filled or fully filled orbitals in the same sub shell)
having no attraction for electron because by accepting electron their configuration becomes less stable. In that case energy has to be supplied to accept electron. Thus electron gain enthalpy will be positive.

Question 4. Discuss the factors that influence the magnitude of ionization enthalpy. What are the general trends of variation of ionization enthalpy in the periodic table? Explain.
Answer: Factors affecting Ionization enthalpy.

1. Atomic size. With the increase in atomic size, the number of electron shells increases and thus the force of attraction between the electrons and the nucleus decreases. Therefore the ionization enthalpy decreases.

2. Nuclear charge. As the nuclear charge increases the attraction for the electron also increases that's why ionization enthalpy increases.
3. Screening or shielding effect. In a multi-electron atom, the electron present in the inner shells shield the electrons in the valence shell as a result these electrons experience less attraction from the nucleus. This leads to lesser ionization enthalpy.
    - Variation along a period. On moving from left to right in a period the nuclear charge increases and the atomic size decreases as a result ionization enthalpies are expected to increase.
    - Variation within a group. On moving down the group as the atomic size of the elements increases that's why ionization enthalpy decreases down the group.

Question 5. (a) How does atomic radius vary in group in the periodic table?
(b) Explain
(i) Radius of cation is less than that of the atom.
(ii) Radius of anion is more than that of the atom.
(iii) In iso-electronic ion, the ionic radii decreases with increase in atomic number.
Answer:
(a) Variation of atomic radius in a group:
On moving down the group there is an increase in the principal quantum number and therefore no. of electron shells increases and thus the atomic size increases. Thus the atomic radii of the element increases.
(b) (i) Radius of cation is less than that of the atom:
Since the cation is formed by losing of one or more electrons.
For example,

$Na \rightarrow Na^{+} + e^{-}$

Thus the radius of $Na^{+}$will be less than the Na.
(ii) Radius of anion is more than that of the atom.
Since the anion is formed by gaining one or more electron.
Therefore, the atomic radius is larger than the corresponding atom.
(iii) In iso-electronic ions, atoms have same number of electrons but different magnitude of nuclear charges. As the nuclear charge increases ionic radius decreases.
For example. $N^{3-}$, $O^{2-}$, $F^{-}$ have same No. of electrons = 10 but different ionic radii = 171, 140, 136 respectively.

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