Chapter 3. Classification of Elements and Periodicity in Properties

Question-1

Why is electro negativity a relative property?

Solution:

The tendency of an atom to attract pair of electrons in a bond is called electro negativity. It cannot be determined by experiment. It can be calculated. It has no unit. Arbitrarily electro negativity values for F, C, and H are given as 4,2.5 and 2.1 respectively.

Question-2

Which element has the highest electro negativity value?

Solution:

Chlorine has highest electron affinity value. Fluorine has lesser electron affinity value than chlorine due to its high electron density (electron density $= \frac{\text{Ch arg e}}{\text{radius}}$) Radius of F is lesser than Cl.

Question-3

The first ionization of carbon atom is greater than that of boron atom where as the reverse is true for second ionization energy.

Solution:

Carbon atom has $1s^2 2s^2 2p^2$ configuration. After first ionization it has $1s^2 2p^2 2s^1$ configuration. Single electron can be easily removed from 2p orbital. Hence second ionisation of carbon is lesser than first ionization. Boron has $1s^2 2s^2 2p^1$ configuration. One electron in the 2p orbital can be easily removed. Hence first ionisation for B is less: After losing first it has $1s^2 2s^2$ configuration from which removed of an electron is difficult. Hence second ionization for B is greater than first ionisation.

Question-4

Electron affinity of noble gases are zero and those of N and P are very low Give reason.

Solution:

Noble gases have stable electronic configuration – s^2p^6. All electron are in paired condition. Hence, addition of an electron is difficult and it may require supply of energy. Hence electron affinity may be zero or negative values.

N and P have stable half filled 'p' orbitals. Hence addition of an electron is not required, to make it stable. Hence they have very low values.

Question-5

Arrange ions in the increasing order of its size O^{2-}, F^-, Na^+, N^{3-}.

Solution:

	Proton numbers	Electrons numbers
O^{2-}	8	10
F^-	9	10
Na^+	10	10
N^{3-}	7	10

All ions have same number of electrons but different proton numbers. Greater the number of protons greater will be the nuclear force and small will be the size.

$Na^+ < F^- < O^{2-} < N^{3-}$.

Question-6

How will you explain the correct order of size Ne>B>C>F?

Solution:

The decrease in size along a period is due to the effect of successive increasing nuclear charge without addition of a new shall. Nuclear charge increases for +5 in B to +9 in F. But electrons are added only to the same second shell, for all above elements.

For inert gases like Ne, their atomic radii are only the Vander Wall's radii. Vander wall's radii are naturally higher than the covalent radii of older elements.

Question-7

Arrange Fe, Fe^{3+}, Fe^{2+} in the increasing order of size.

Solution:

$Fe^{3+} < Fe^{2+} < Fe$

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Fe^{3+} has lesser number of electrons than Fe^{2+} Hence nuclear force of attraction will be more for Fe^{3+}. Hence it has the least size.

Question-8

Which are metalloids among the following? Li, Be, Si, Ge, As, sb, Te.

Solution:

Si, Ge, As, Sb, and Te are metalloids which have properties of both metals and non-metals.

Question-9

What would the expected outmost electronic configuration, the groups and period, and block for elements with 114, 116 and 118?

Solution:

Their electronic configuration is $7S^2$,$7P^2$,$7S^2$,$7P^4$, & $7s^2$ $7p^6$ respecting. 114, 116, 118 all belongs to p block elements. Since 114 has s^2p^2 to belongs to 14 the group,116 has s^2p^4 it belong to 16 the group. 118 has s^2p^6, it belongs to 18^{th} group. The three elements have 7S & 7P; Hence they belong to 7^{th} period.

Question-10

Xenon form compounds with fluorine and oxygen. But neon does not . Why?

Solution:

In a group as we move from He to Xe, size increases and ionisation enthalpy decreases. Hence, Xe, (n = 5) has lower ionisation enthalpy than Ne (n = 2).

More over Xe has ($5s^2 5p^6 5d^0$) empty 5d orbitals, with which it can accept pairs electrons from other elements and thus can form compounds. Neon has no 'd' orbital in its electronic configuration ($1s^2 2s^2 2p^6$).