Q. Find out the position of the following elements in the periodic Table.

(i) K (19) (ii) Zn (30) (iii) Cu (29)
(iv) Br (35) (v) Cr (24) (vi) Fe (26) (vii) P (15)
(viii) Mn (25) (ix) S (16)

Soln: The E.C (electronic Configuration) of K is given below:

(i) $K(19) \longrightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

From the e.c of K is found that the last electron enter into the fourth orbit, so its period is 4 and group 1A.

(ii) The E.C of Zn (30) is given below:

$Zn(30) \longrightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$

From the E.C of Zn, we can see that the maximum quantum number is 4, so the period is 4 and the valence electron is (2+0) = 2 and enter into the d orbital so the name of group is IIB

(iii) $Cu(29) \longrightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$
or
$4s^1 3d^{10}$

From the E.C of Cu we can see that the maximum number of quantum number is 4 so the period is 4, and the valence electron 1 enter into the d orbital.

So name of the group IB

(iv) Cr (24)

→ $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$

from the E.c of Cr we can see that the maximum quantum Number is 4 so the period is 4
And the total valence electron (1+5) = 6 and enter into the d orbital. So the name of the group VI B

(v) Br (35)

The E.c of Br is given below

→ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$

period : 4

Number of valence electron (2+5) = 7 and enter into the p orbital. So the name of the group is VII A

(vi) Fe (26)

→ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

Name of the period is 4 th period

Total valence electron is (2+6) = 8 and enter into the d-orbital So the name of the group is VIII B

(vii) P (15)

→ $1s^2 2s^2 2p^6 3s^2 3p^3$

Name of the period is 3

Total valence electron (2+3) = 5 enter into the p orbital so the group name is V A

(viii) Mn (25)

$\longrightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$

Name of the period is 4 and total valence electron $(2+5) = 7$ enter into the d orbital

So the name of the group is VII B

(ix) S (16) $\longrightarrow 1s^2 2s^2 2p^6 3s^2 3p^4$

Name of the period is 3

Total Number of valence electron is $(2+4) = 6$ and enter into the p orbital. So the group name is VI A.

for: H.W

Cl (17), Ca (20), Sc (21), As (33)
Se (34), Rb (37), Sr (38), Y (39)
Zr (40), Ni (28), Co (27), Nb (41), Mo (42)

At first draw the electronic configuration and find out the period and name of the group.

* Rule: 01 If the electron enter into s and p orbital (s^1 — to s^2p^5) then the position of group I — to VII

Rule-02: if the E.c of the element is s^2p^6 then it is consider '0' group

Rule-03: Again the outermost electron capacity of d and s orbital determine the group

Such as — $3d^1 4s^2$

= III group

Rule-04: But the electron capacity when more than 8, 9 10 then it is consider VIII group.

Fe_{26} ⟶ $3d^6 4s^2$: VIII group

Co_{27} ⟶ $3d^7 4s^2$: VIII group

Ni ⟶ $3d^8 4s^2$: VIII

Rule-05: obviously when the electron capacity is more than 10 then it is not consider d orbital only for s orbital.

for example:

Cu_{29} ⟶ $3d^{10} 4s^1$: I group

(i) A Subgroup: if there is no d orbital or d orbital is already filled the preor stage then it is consider A Sub group.

From the E.c of $_{17}Cl$ we can see

$_{17}Cl \longrightarrow 1s^2 2s^2 2p^6 3s^2 3p^5$: VII A

$_{31}Ga \longrightarrow 3d^{10} 4s^2 4p^1$: III A

(II) B- Subgroup: if the outermost d orbital electron is about to come (d^1 – d^{10}) then it is consider B subgroup. for example

$_{21}Sc \longrightarrow 3d^1 4s^2$: III B

$_{30}Zn \longrightarrow 3d^{10} 4s^2$: II B

Period: the maximum number of quantum number determine the period.

Q.01. Classify the following Species into two groups of Species which should be isoelectronic.

K^+, NO^+, Ca^{+2}, C_2^{2-}, Sc^{3+}, CN^-, Cl^-, N_2

Soln. Find out the number of electrons in the given Species, $K^+ = 19-1 = 18$,

$NO^+ = 7+8-1 = 14$

$Ca^{2+} = 20-2 = 18$

$C_2^{2-} = 6\times2+2 = 14$

$Sc^{+3} = 21-3 = 18$

$CN^- = 6+7+1 = 14$

$Cl^- = 17+1 = 18$

$N_2 = 2\times7 = 14$

The given species can be classified into the following two groups:

(i) K^+, Ca^{+2}, Sc^{+3}, Cl^- (All contain 18 electrons)

(ii) NO^+, C_2^{2-}, CN^-, N_2 (All contain 14 electrons)

Q.2. Arrange the following atoms / ions in the increasing order their size.

(i) F^-, Al, Na^+, Mg^{+2}

(ii) Ca^{+2}, Ar, K^+, Cl^-, S^{2-}

Soln: Since F^-, Na^+, and Mg^{+2} ions are isoelectronic ($F^- = 9+1 = 10$, $Na^+ = 11-1 = 10$, $Mg^{+2} = 12-2 = 10$), their size increases with the decrease of their atomic number. Then:

Mg^{2+} $(Z=12)$ < Na^+ $(Z=11)$ < F^- $(Z=9)$

Now since $F^- < Al$, the overall increasing order is

$Mg^{2+} < Na^+ < F^- < Al$ (Ans)

(ii) Since all the given species are isoelectronic ($Ca^{+2} = 20-2 = 18$, $Ar = 18$, $K^+ = 19-1 = 18$, $Cl^- = 17+1 = 18$, $S^{2-} = (16+2) = 18$) their size increases with the decrease of their atomic number.

Thus:

	Ca^{+2}	$<$	K^+	$<$	Ar	$<$	Cl^-	$<$	S^{2-}
$Z =$	20		19		18		17		16

Q4. Arrange the elements with E.C's $[He]\,2s^1$, $[Ne]\,3s^1$ and $[Ar]\,4s^1$ in the decreasing order of their IE1 values.

Soln: E.C's show that, the given elements belong to group 1. Since IE1 values decrease on moving down the group, IE1 values of the given elements decrease as:

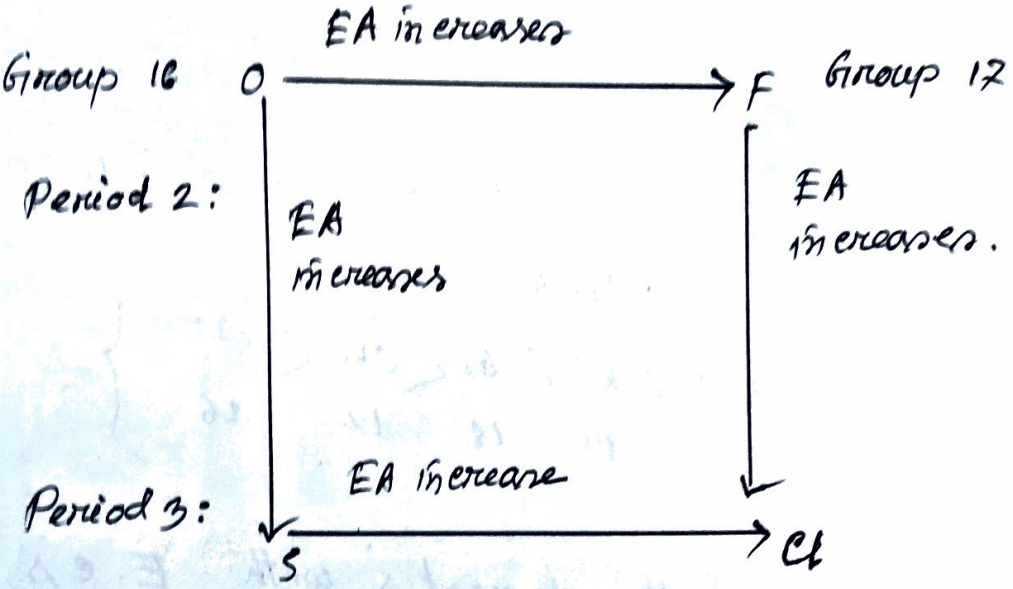
$[He]\,2s^1 > [Ne]\,3s^1 > [Ar]\,4s^1$.

Q5 **Q. Arrange F, Cl, O and S in the increasing order of their E.A values.

Ans. E.A values of the given elements are in the following increasing order:

$O < S < F < Cl$

Explanation: On the basis of the position of the given elements in the long form of periodic table the variation of their EA values can be shown as:



Hence the increasing order of EA values is O < S < F < Cl

06 ** Q. The electronic configurations for four elements A, B, C and D are as:

$A = 1s^2 2s^2 2p^6 3s^1$

$B = 1s^2 2s^2 2p^6 3s^2$

$C = 1s^2 2s^2 2p^1$

$D = 1s^2 2s^2 2p^6 3s^2 3p^1$

Predict which of these elements has maximum value of $(IE_2 - IE_1)$

Soln: IE_1 and IE_2 values for the given elements correspond to the following ionisation processes.

$1s^2 2s^2 2p^6 3s^1 \xrightarrow[IE_1]{-3s^1 (n=3)} 1s^2 2s^2 2p^6 \xrightarrow[IE_2]{-2p^1 (n=2)} 1s^2 2s^2 2p^5$

(A)

$1s^2 2s^2 2p^6 3s^2 \xrightarrow[IE_1]{-3s^1 (n=3)} 1s^2 2s^2 2p^6 3s^1 \xrightarrow[IE_2]{-3s^1 (n=3)} 1s^2 2s^2 2p^6$

(B)

$1s^2 2s^2 2p^1 \xrightarrow[IE_1]{-2p^1} 1s^2 2s^2 \xrightarrow[IE_2]{-2s^1 (n=2)} 1s^2 2s^1$

(C)

$1s^2 2s^2 2p^6 3s^2 3p^1 \xrightarrow[IE_1]{-3p^1 (n=3)} 1s^2 2s^2 2p^6 3s^2 \xrightarrow[IE_2]{-3s^1 (n=3)} 1s^2 2s^2 2p^6 3s^1$

(D)

In case of A 1st electron is removed from 3s orbital ($n=3$) and 2nd electron is removed from 2p orbital ($n=2$). Since 3s orbital belongs to outer orbit ($n=3$) and 2p orbital belongs to inner orbit ($n=2$), ($IE_2 - IE_1$) for this element is maximum. In case of other elements the orbitals from which electron (s) is (are) removed belong to the same shell.

07 ** Arrange C, N, O and F in the decreasing order of their IE_2 values.

Soln: The decreasing order of IE_2 values is

O > F > N > C

Explanation. IE_2 value of an element A is the energy required to remove an electron from A^+ cation. V.S.E. cn of C^+, N^+, O^+ and F^+ cations are as:

$C^+ = 2s^2 2p^1$

$N^+ = 2s^2 2p^2$

$O^+ = 2s^2 2p^3$ and

$F^+ = 2s^2 2p^4$. Since O^+ cation has half-filled 2p orbitals, $2s^2 2p^3$ configuration is stable. Hence IE_2 of O-atom would be higher than that of F (O > F). Now since C-atom is larger in size than N-atom. IE_2 of C would be lower than that of N (N > C). Then the overall decreasing order is

O > F > N > C

08. ** Q. Which of the following species has the smallest value of IE O, $\bar{O}$, O^{2-} and O^+ ?

Soln: The size of the given species increases in the order:

$O^+ < O < \bar{O} < O^{2-}$.

Since O^{2-} is the largest in size, it is easiest to remove an electron from this ion. Hence IE value of O^{2-} ion is the smallest.

Q. In which of the following processes energy is absorbed. ?

(a) $Cl(g) + \bar{e} \rightarrow Cl^-(g)$ (b) $O^-(g) + \bar{e} \rightarrow O^{2-}(g)$

(c) $O(g) + \bar{e} \longrightarrow O^-(g)$ (d) $S(g) + \bar{e} \longrightarrow S^-(g)$

Soln: When an electron is added to a neutral gaseous atom (A) energy is released. Thus in the processes (a) (c) and (d) energy is released. on the other hand, when an electron is added to a given A- ion energy is absorbed (required). Thus in process (b) energy will be absorbed In process (b) energy is absorbed to overcome the repulsion between the incoming and negative charge on $O^-(g)$ ion.