The electronic range for the purpose of calculating the shielding constant shall be written as follows:

(1s) (2s=2p) 3s=3p, 3d, (4s=4p, 4d, 4f), (5s=5p)

Example: Calculate the effective charge of the nucleus on the end of the electron in the fluorine atom, the atomic number equals 9?

Answer:

^{9}F $(1s)^2$ $(2s^2=2p^5)^7$

$S = 6 * 0.35 + 2 * 0.85$

$S = 2.10 + 1.70$

$S = 3.80$

$Z^{*} = Z - S$

$= 9 - 3.8$

$= 5.2$ الشحنه المؤثره للنواه

Example: Calculate the effective charge of the nucleus felt by the tenth electron in the calcium atom ^{20}Ca?

Answer: $(1s)^2$ $(2s=2p)^8$ $(3s=3p)^8$ $3d^0$ $(4s=4p)^2$

$S = 7 * 0.35 + 2 * 0.85$

$S = 2.45 + 1.70 \longrightarrow 4.15$

Note: $Z^{*} = 20 - 4.15 = 15.85$

All the electrons to the right of the electron concerned, المعنى whether the electron in question, s, p, d, does not enter into the shielding constant calculation.

Example: Calculate the effective charge of the nucleus on the last electron in the iron atom?

$^{26}Fe\ (1s)^2\ (2s=2p)^8\ (3s=3p)^8\ \underbrace{(3d)^6}_{n}\ (4s=4p)^2$

$S = 5 * 0.35 + 18 * 1$

$S = 1.75 + 18 \Longrightarrow 19.75$

$Z^{*} = 26 - 19.75$

$= 6.25$

Example: Calculate the effective charge of the nucleus on the last electron in the oxygen ion O^{-2}, atomic number is equal to 8?

Note: We use Z atomic number of the neutral (المتعادلة) state

$^{10}O^{-2}\quad 1s^2\ (2s=2p)^8$

$S = 7 * 0.35 + 2 * 0.85$

$S = 2.45 + 1.70$

$S = 4.15$

$Z^{*} = 8 - 4.15$

$= 3.85$

Example: Find the effective charge of the nucleus on the last electron in the ferric ion Fe^{3+} atomic number equal to 26?

^{26}Fe . . . . . $4s^2\ 3d^6$

$^{23}Fe^{+3}\ (1s)^2\ (2s=2p)^8\ (3s=3p)^8\ (3d)^5\ 4s^0$

$S = 4 * 0.35 + 18 * 1$

$S = 1.40 + 18$

$S = 19.4$

$Z^* = 26 - 19.4$

$= 6.6$

Periodic Properties

The physical and chemical properties of the elements:

1. Atom radius نصف قطر الذرة

One of the methods used to measure the atomic radius is to measure the distance between two symmetric and chemically unifying يتحد atoms and then divide the distance measured by two, as shown in Fig., and can thus be defined The atomic radius is about half the distance between two symmetric atoms of a chemically united two atoms.

Fig.: Atom radius نصف قطر الذرة

It is noted that the elements within the period one less radius as we move from left to right, increasing the number of atoms where the attraction power between electrons within the main level with the positive charge of the nucleus increases the number. As for the groups, the radius increases as we move from top to bottom in the table and move away the external electrons from the nucleus, as shown in Fig.

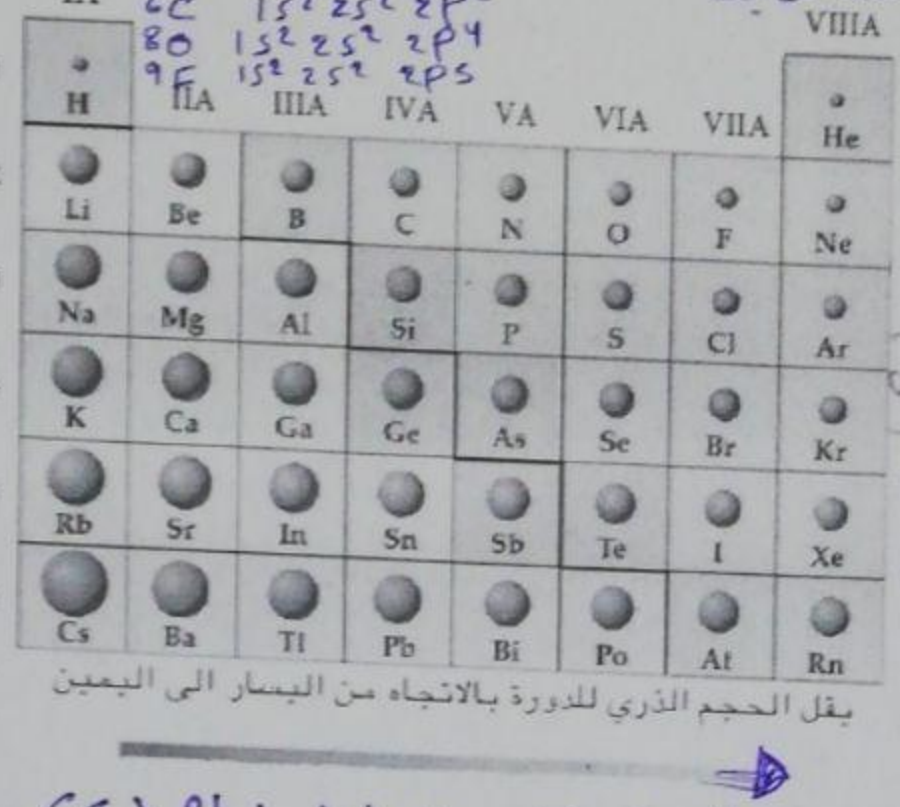
مثال :- رتب العناصر التاليه حسب زيادة نصف قطرها الذري
arrangement the following element accarding to increasing of radius atoms

$_3Li$ $1s^2 2s^1$
$_6C$ $1s^2 2s^2 2p^2$
$_8O$ $1s^2 2s^2 2p^4$
$_9F$ $1s^2 2s^2 2p^5$

نلاحظ ان العناصر تقع ضمن الدوره الثانيه

وعليه يكون الترتيب
$_3Li > {}_6C > {}_8O > {}_9F$

لان اتجاه الزياده من اليمين الى اليسار



مثال (2)
$_{20}Ca$, $_{12}Mg$, $_4Be$

$_4Be$ $1s^2 2s^2$

$_{12}Mg$ $1s^2 2s^2 2p^6 3s^2$

$_{20}Ca$ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

$\therefore {}_{20}Ca > {}_{12}Mg > {}_4Be$

لان اتجاه الزيادة من الاعلى الى الاسفل

يزداد الحجم الذري باتجاه الاسفل

$Cs > Rb > K > Na$ ∴ يزيد الحجم الذري

$Li > Be > B > C$

2. Ionization Energy

Ionization energy is defined as the amount of energy needed to remove one electron from the external energy level of a certain element of a given charge in its gas state.

$$Na + \text{Ionization energy} \longrightarrow Na^+ + e$$

In the ionization of the sodium atom, the ionization energies in the group range from top to bottom. The increasing in the atomic number with decreased ionization energy for this metal.

The electrons of the outer shells الاغلفة move away from the nucleus, making it easier to lose one. In period, the ionizing energies of the elements increase as the atomic number of the element increases due to the increase of the positive charge within the

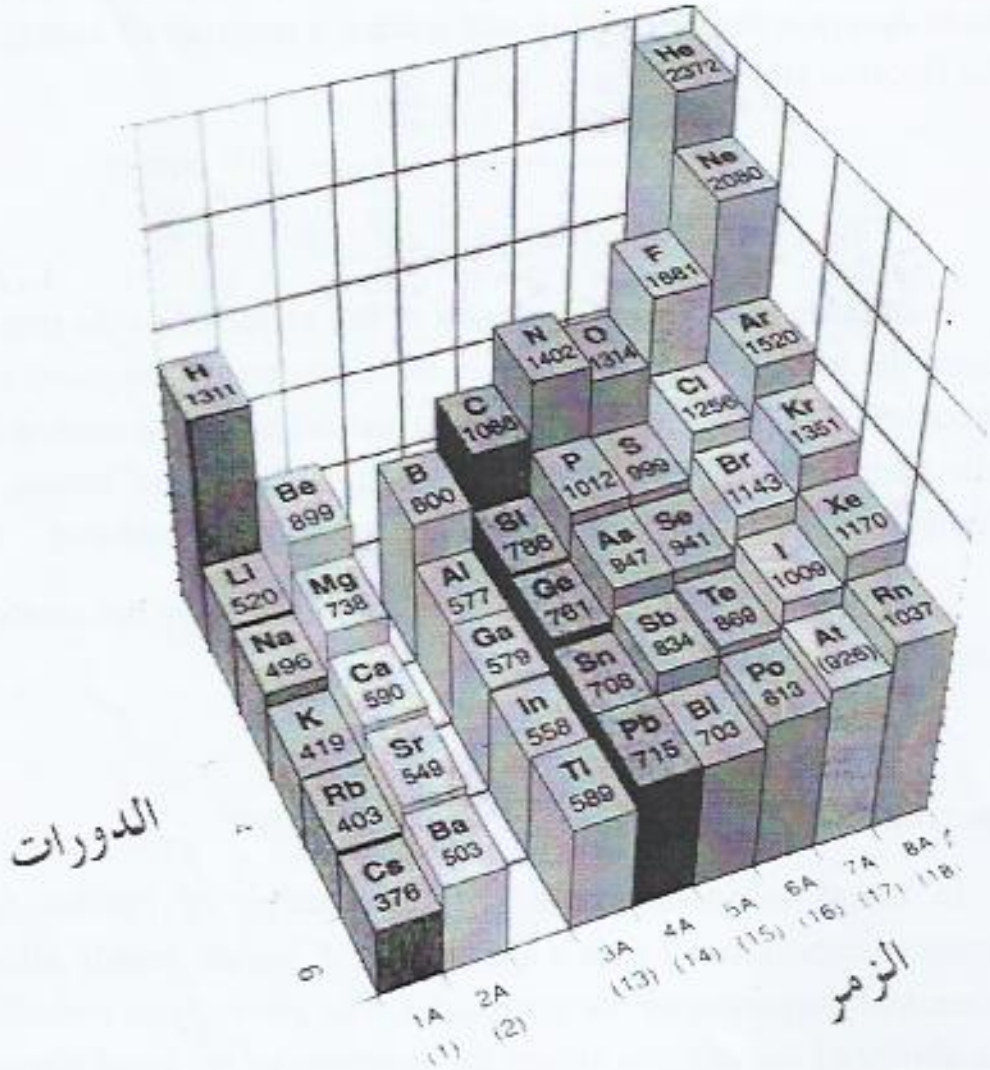
يزداد جهد التأين في الدورة ←

يزداد جهد التأين في الزمرة ↑

$_{10}Ne > {}_9F > {}_7N > {}_8O$ ....

$_3Li > {}_{11}Na > K > Rb$

nucleus and the electrons stay at the same level of the main external energy.



استثناء

An exception to this increase is that if the atom has a saturated secondary shell such as ns^2 or half saturated like np^3, its ionization energy is greater than the ionization energy of the atom after which ^7N is the largest ionization energy of ^8O despite of the oxygen atom is the largest atomic number of the nitrogen atom , They fall into one period. Noble elements possess the highest ionizing energy because they do not lose their electrons easily.

nucleus and the electrons stay at the same level of the main external energy.

رتب العناصر التالية حسب زيادة طاقة التأين

H.W $_{4}Be$, $_{12}Mg$, $_{20}Ca$

$_{4}Be$ $1s^2 2s^2$

$_{12}Mg$ $1s^2 2s^2 2p^6 3s^2$ حسب الزمر

$_{20}Ca$ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

↑ من الأسفل الى الأعلى تزداد

$_{4}Be > {}_{12}Mg > {}_{20}Ca$

$_{13}Al$, $_{14}Si$, $_{16}S$

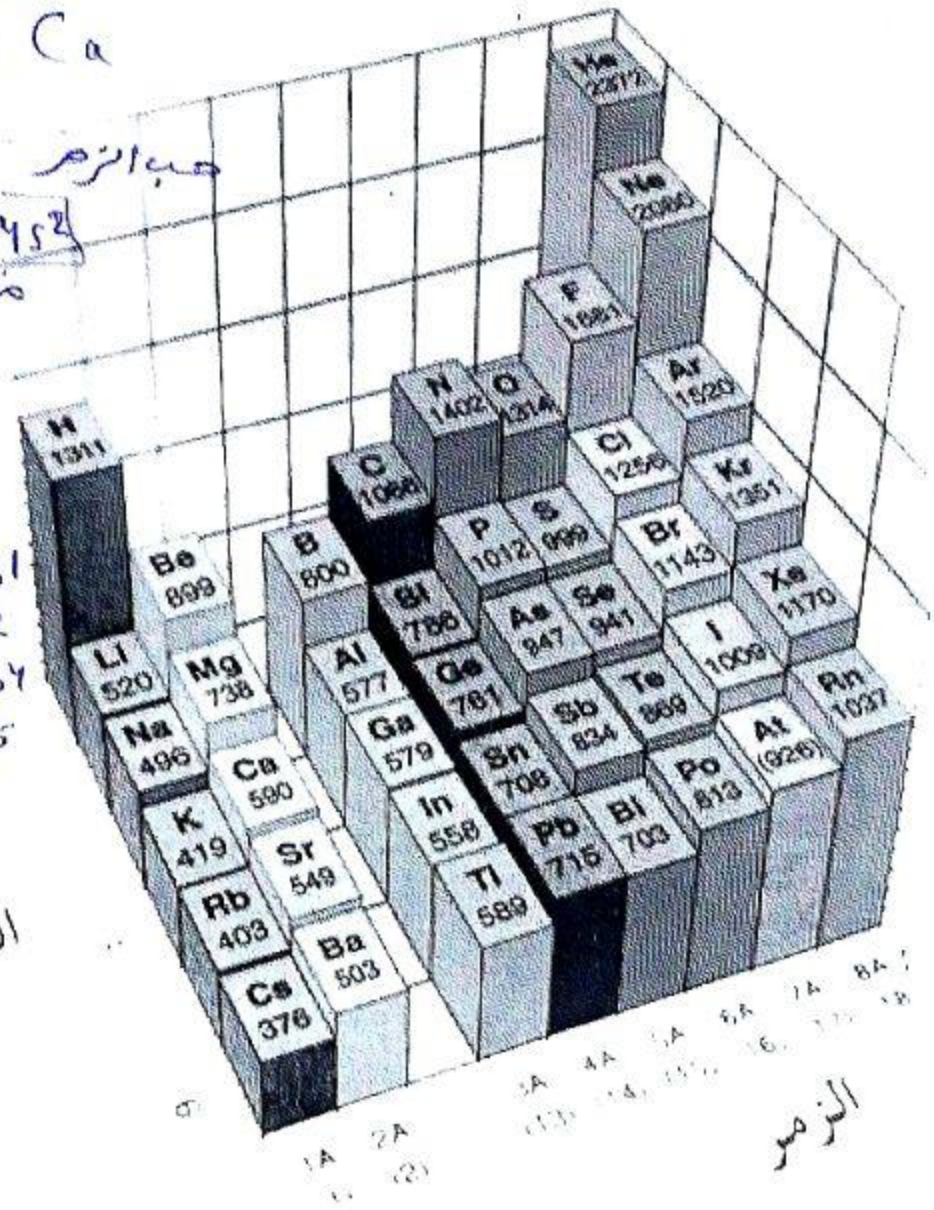
$_{13}Al$ $1s^2 2s^2 2p^6 3s^2 3p^1$

$_{14}Si$ $1s^2 2s^2 2p^6 3s^2 3p^2$

$_{16}S$ $1s^2 2s^2 2p^6 3s^2 3p^4$

حسب الدورات ← تزداد

$_{16}S > {}_{14}Si > {}_{13}Al$



استثناء

An exception to this increase is that if the atom has a saturated secondary shell such as ns^2 or half saturated like np^3, its ionization energy is greater than the ionization energy of the atom after which ^{7}N is the largest ionization energy of ^{8}O despite of the oxygen atom is the largest atomic number of the nitrogen atom , They fall into one period. Noble elements possess the highest ionizing energy because they do not lose their electrons easily.

يلاحظ بان كل N, Be لهما طاقة تأين اعلى من الموقع

$_{3}Li$ $_{4}Be$ $_{5}B$ $_{6}C$ $_{7}N$ $_{8}O$ $_{9}F$ $_{10}Ne$

5.4 9.3 8.3 11.3 14.5 13.6 17.4 21.6

بسبب الترتيب الالكتروني حيث يصبح الغلاف الخارجي يحتوي مستقر

$_{4}Be$ $1s^2 2s^2$ يشبع وظائفه

$_{7}N$ $1s^2 2s^2 2p^3$ يشبع ونصف يشبع

تزداد طاقة التأين