University of Mohamed Khider, Biskra
Faculty of Exact Sciences, Natural and Life Sciences
Department: Materials Science
First Year - Common Trunk

Academic Year: 2023/2024
Course: Chemistry 1

Series N° : 4

Exercise 1:

1- Provide the electron distribution for the following atoms and ions, and represent the valence shell using quantum numbers:

$_{7}N$, $_{7}N^{3-}$, $_{15}P$, $_{15}P^{3+}$, $_{30}Zn$

- Determine the four quantum numbers for the penultimate electron.

2- Among the sets of quantum numbers below, identify those representing possible states and those representing impossible states, with justification.

a) $n=2$, $\ell=1$, $m_l= -1$
b) $n=1$, $\ell=0$, $m_l= 2$
c) $n=2$, $\ell=1$, $m_l= 0$, $m_s= 0$
d) $n=2$, $\ell=2$, $m_l= -1$
e) $n=3$, $\ell=0$, $m_l= 0$, $m_s= -1/2$

Exercise 2:

Consider the following element: $_{4}Be$

part 1:

1-Establish the electrical configuration of Be.

2- Using Slater's rules, calculate the effective nuclear charge Z^* felt by an electron in the (1s) and (2s) orbitals for the Be atom.

3- Deduce the orbital energy of an electron in the (1s) and (2s) orbitals of Be.

4- Calculate the total energy of the electrons in Be.

part 2:

1-Establish the electrical configuration of Be^+.

2- Using Slater's rules, calculate the effective nuclear charge Z^* felt by an electron in the (1s) and (2s) orbitals for the Be^+ ion.

2- Deduce the orbital energy of an electron in the (1s) and (2s) orbitals of Be^+.

Calculate the total energy of the electrons in Be^+.

part 3:

1- Calculate the energy of the first ionization.
2- Calculate the energy of the second ionization.
3- Calculate the energy of the third ionization.
4- Calculate the energy of the fourth ionization.

Exercise 3:

1- Provide the electron distribution, core electrons, and valence electrons for the following elements Tc (Z=43) and Ir(Z=77).

2- Specify the period, Column, and atomic number of elements that have the electron distribution in their outermost shells as follows:

$$5s^2\,;\ 3s^23p^3\,;\ 4s^23d^{10}4p^2\ ;\ 4s^23d^7$$

Exercise 4:

1- Provide the abbreviated electron distribution for the atoms of the following elements:

$_{24}Cr$, $_{35}Br$, $_{47}Ag$, $_{80}Hg$

2-Identify the location of the previous atoms in the periodic table (period, group, column, block).

3-Iodine (I) belongs to the same group as Bromine (Br) and the same period as Silver (Ag). What is its electron configuration and atomic number?

4-Write the electron configuration for element X, which belongs to the same group as Nitrogen $_7N$ and comes after it in the periodic table.

Exercise 5:

The chemical element X is situated in the box resulting from the intersection of the second column with the third row.
Determine its atomic number, Z.
Write the expected symbol for the most stable ion and its electron configuration.
Element Y is located in the box above the one containing element X. Write the electron configuration for element Y. Then, deduce its atomic number, Z.

Exercise 6:

Let the elements D-C-B-A correspond to the following atomic numbers: 2-18-36-86.
1- Provide the period, group, and block for each element.
2- Match each element with the appropriate ionization energy value from the following: 15.7eV, 10.75eV, 24.58eV, 13.59eV.
3- Arrange these elements in ascending order of half the atomic radius.
4- Arrange these elements in ascending order of electronegativity.