Atomic Number: Atomic number of an element is equal to the number of protons in the nucleus of the atom of that element.

The term atomic number is also reffered to as proton number. Since the atom as a whole is electrically neutral, the atomic number(Z) is equal to the number of extranuclear electrons.

Mass Number: Mass number of an atom is equal to the total number of nucleons in the nucleus of an atom.

The term mass number also thus represents the total number of protons and neutrons of an atom. It is expressed by symbol, A.

Since electrons have practically no mass, the entire atomic mass is due to protons and neutrons. each of which has a mass atmost exactly one unit. Therefore, the mass nuber of an atom can be obtained by rounding off the experimental value of atomic mass (or atomic weight) to the nearest whole number. For example, the atomic mass of sodium and fluorine obtained by experimentat is 22.9898 and 26.9815 amu respectively. Thus their mass numbers are 23 for sodium and 27 for fluorine.

Solve Problem: Uranium hass atomic number 92 and atomic weight 238.029. Give the number of electrons, protons and neutrons in its atom.

Solution: Atomic nuber (Z) of Uranium = 92

$\therefore$ Number of Protons = 92

and nuber of electron = 92

We know that Mass number (A) = N + Z   Where N = number of Neutros.

$\therefore N = A - Z$

Mass nuber (A) is obtained by roundlng off the atomic weight

$= 238.029 = 238$

$N = 238 - 92 = 146$

$\therefore$ Thus Uranium has 92 electrons, 92 protons, and 146 neutrons.

A total of four quantum numbers are used to describe completely the movement and trajectories of each electron within an atom. The combination of all quantum numbers of all electrons in an atom is described by a wave function that complies with *the Schrödinger equation*. Quantum numbers are important because they can be used to determine the electron configuration of an atom , the probable location of the atom's electrons and used to determine other characteristics of atoms, such as ionization energy and the atomic radius.

1.The Principal Quantum Number (n)

The principal quantum number, n , designates the principal electron shell. Because n describes the most probable distance of the electrons from the nucleus, the larger the number n is, the farther the electron is from the nucleus, the larger the size of the orbital, and the larger the atom is. n can be any positive integer starting at 1, as n=1 designates the first principal shell (the innermost shell). n=1,2,3,4

EXAMPLE

If an electron jumped from energy level $n = 5$ to energy level $n = 3$, did absorption or emission of a photon occur?

SOLUTION

emission, because energy is lost by release of a photon.

2.The Orbital Angular Momentum Quantum Number (l)

The orbital angular momentum quantum number l determines the shape of an orbital, and therefore the angular distribution. The number of angular nodes is equal to the value of the angular momentum quantum number l. Each value of l indicates a specific s, p, d, f subshell. The value of l is dependent on the principal mℓ or m - magnetic quantum number - describes the orbital of the subshell quantum number n. Unlike n, the value of l can be zero.

3.The Magnetic Quantum Number (ml)

The magnetic quantum number ml determines the number of orbitals and their orientation within a subshell. Consequently, its value depends on the orbital angular momentum quantum number l. Given a certain l, ml is an interval ranging from $-l$ to $+l$, so it can be zero, a negative integer, or a positive integer.

$$ml=-l,(-l+1),(-l+2),\ldots,-2,-1,0,1,2,\ldots(l-1),(l-2),+l$$

4.The Electron Spin Quantum Number (ms)

It describe the direction of the electron spin and may have a spin of +1/2, represented by↑, or −1/2, represented by ↓. This means that when ms is positive the electron has an upward spin, which can be referred to as "spin up." When it is negative, the electron has a downward spin, so it is "spin down."

$$ms=\pm 1/2$$

Pauli Exclusion Principle

The Pauli Exclusion Principle states that, in an atom or molecule, no two electrons can have the same four electronic quantum numbers. As an orbital can contain a maximum of only two electrons, the two electrons must have opposing spins. This means if one is assigned an up-spin (+1/2), the other must be down-spin (-1/2).

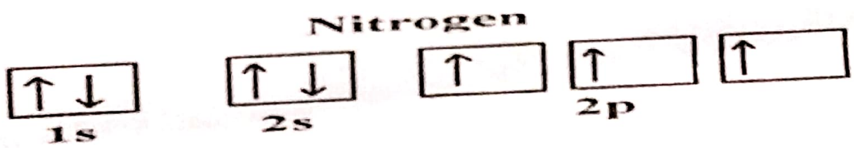
Hund's rule:

1. Every orbital in a sublevel is singly occupied before any orbital is doubly occupied.
2. All of the electrons in singly occupied orbitals have the same spin (to maximize total spin).

When assigning electrons to orbitals, an electron first seeks to fill all the orbitals with similar energy before pairing with another electron in a half-filled orbital. Atoms at ground states tend to have as many unpaired electrons as possible.

Example: Nitrogen Atoms

Consider the correct electron configuration of the nitrogen ($Z = 7$) atom: $1s^2\ 2s^2\ 2p^3$



Atomic Number

The atomic number of an element is equal to the total number of protons in the element's nucleus and is commonly represented as the letter Z. Different isotopes of an element have the same atomic number, but will have different atomic masses.

The lowest atomic number is 1, which is hydrogen (H), and currently the highest known atomic number is 118.

Isotopes

Atoms that have the same atomic number (number of protons), but different mass numbers (number of protons and neutrons) are called isotopes.

There are naturally occurring isotopes and isotopes that are artificially produced