Inorganic Chemistry is the chemistry of all elements and all their compounds except those containing carbon.

Atoms are composed of three type of particles : protons , neutrons , and electrons .

The nucleus is at the centre of the atom and contains the protons and neutrons .

Almost all the mass of the atom is concentrated in the nucleus,because the electrons mass is so little .

	Relative mass	charge
Proton	1	+1
Neutron	1	0
Electron	1/1836	- 1

Atomic number of the atom = No.of Protons = No.of Electrons

Mass number of the atom = No.of Protons + No. of Neutrons

No. of Protons = Atomic number → 11

Na

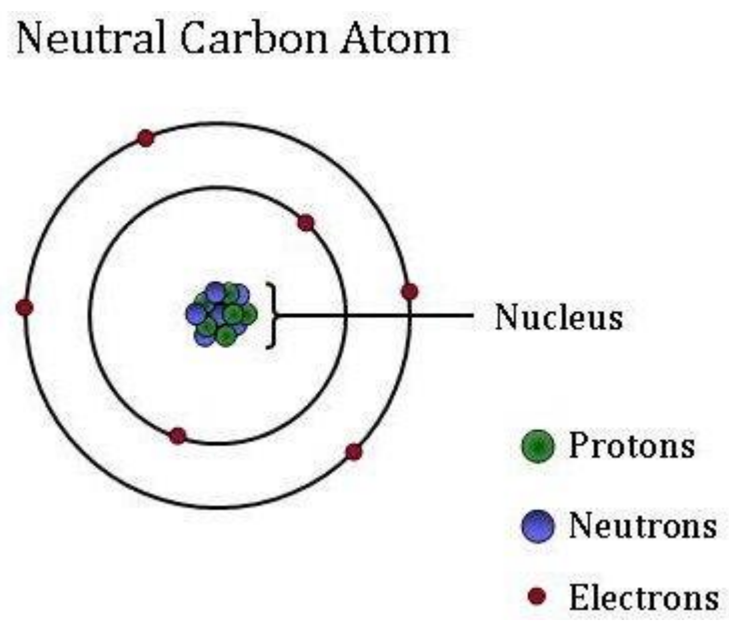
No.of Protons + No.of Neutrons = Mass number → 23

The atomic number counts the number of protons(11) ; the mass number counts protons + neutrons (23).

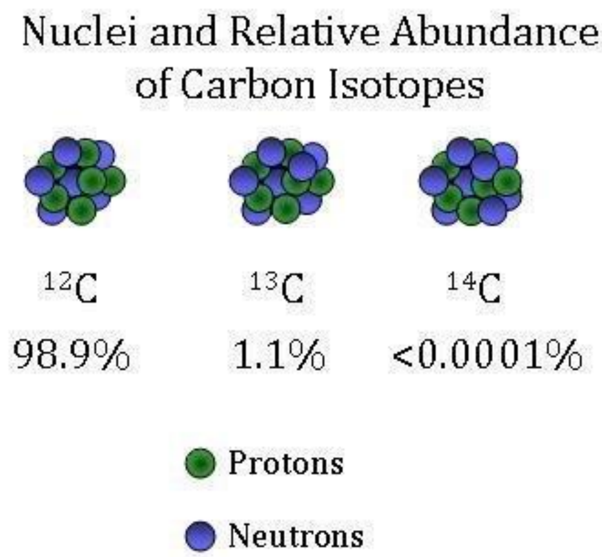
Isotopes

Isotopes are atoms which have the same atomic number but different mass numbers. They have the same number of protons but different numbers of neutrons,which gives them different masses .

The number of neutrons in an atom can vary within small limits. For example,there are three kinds of Carbon atom ^{12}C , ^{13}C and ^{14}C. They all have the same number of protons, but the number of neutrons varies.



The most common isotope of carbon is carbon-12 (^{12}C), which contains six neutrons in addition to its six protons. The next heaviest carbon isotope, carbon-13 (^{13}C), has seven neutrons. Both ^{12}C and ^{13}C are called stable isotopes since they do not decay into other forms or elements over time. The rare carbon-14 (^{14}C) isotope contains eight neutrons in its nucleus. Unlike ^{12}C and ^{13}C, this isotope is unstable, or radioactive. Over time, a ^{14}C atom will decay into a stable product.



	Protons	Neutrons	mass number
Carbon-12	6	6	12
Carbon-13	6	7	13
Carbon-14	6	8	14

Calculating Atomic mass of an element

Atomic mass is a weighted average of the masses of natural isotopes of an element.

Generally,most elements in nature are found in the form of mixture of two stable isotopes (not radioactive) or more.

For example calculating the atomic mass of boron which occurs naturally as 20% boron-10 and 80% boron-11

1- Multiply the mass number of each by its percentage abundance in decimal form

10 x 0.2 = 2

11 x 0.8 = 8.8

2- Add these amounts together to find the atomic mass

2 + 8.8 = 10.8 Dalton or amu

Atoms are electrically neutral, and the positiveness of the protons is balanced by the negativeness of the electrons.

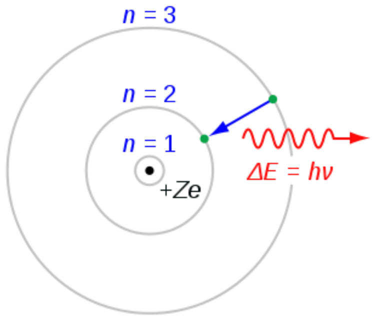
Thus at the neutral atom:

No. of electrons = no. of protons

So, if a chlorine atom (atomic number = 17) has 17 protons, it must also have 17 electrons.

Bohr's Theory

In 1913, Niels Bohr proposed a **theory for the hydrogen atom**, based on quantum theory that some physical quantities only take discrete values. Electrons move around a nucleus, but only in prescribed orbits, and If electrons jump to a lower-energy orbit, the difference is sent out as radiation.



Bohr and Bury Scheme –Important Rules

Maximum number of electrons that can be accommodated in a shell is given by $2n^2$ where n = shell number

- ❖ For 1st energy level, n = 1 Maximum number of electrons in 1st energy level = $2n^2 = 2 \times (1)^2 = 2$
- ❖ For 2nd energy level, n = 2 Maximum number of electrons in the 2nd energy level = $2n^2 = 2 \times (2)^2 = 2 \times 4 = 8$
- ❖ For 3rd energy level, n = 3 Maximum number of electrons in the 3rd energy level = $2n^2 = 2 \times (3)^2 = 2 \times 9 = 18$
- ❖ For 4th energy level, n = 4 Maximum number of electrons in the 4th energy level = $2n^2 = 2 \times (4)^2 = 2 \times 16 = 32$

Electron Shell	Maximum Capacity
K Shell	2 electrons
L Shell	8 electrons
M Shell	18 electrons
N Shell	32 electrons

Quantum Numbers :

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Number	Symbol	Possible Values
Principal Quantum Number	n	$1, 2, 3, 4, \ldots$
Angular Momentum Quantum Number	ℓ	$0, 1, 2, 3, \ldots, (n-1)$
Magnetic Quantum Number	m_l	$-\ell, \ldots, -1, 0, 1, \ldots,$
Spin Quantum Number	m_s	$+1/2, -1/2$

1-The Principal Quantum Number , n (the energy level)

- Determines the size of an orbital(larger n = bigger orbitals)
- Largely determines the energy of the orbital (larger n = higher energy)
- Can take on integar values n = 1,2,3,…,…,
- All electrons in an atom with the same value of n are said to be from the same **principle energy level .**

2- The Angular Momentum Quantum Number ℓ (the sublevel)

- Describes the shape of the orbital
- Affects orbital energies (larger = higher energy)
- All electrons in an atom with the same value of **ℓ** are said to belong to the same sublevels.
- Only integar values between 0,……n-1 are allowed

ℓ	**sublevel**
0	**s**
1	**p**
2	**d**
3	**f**

3-The Magnetic Quantam Number , m_ℓ

- Determines the orientation of orbitals within a sublevel.
- Only integer values between **- ℓ** and **+ ℓ** are allowed .
- The number of **m_ℓ** values within a sublevel is the number of orbitals within a sublevel .

ℓ	possible values of **m_ℓ**	number of orbitals in this sublevel
0	0	1 (s)
1	-1, 0,+1	3(p)
2	-2,-1,0,+1,+2	5 (d)
3	-3 ,-2,-1,0,+1,+2,+3	7 (f)

4-The Spin Quantam Number , m_s (the direction of the arrow)

- Spin can be clockwise or counter clockwise
- Spin quantum number can have values of + ½ or -1/2(arrow up or arrow down)
- Spin makes the electron behave like a tiny magnet

Atomic Number	Element	n	l	m	s	Orbital name
1	Hydrogen	1	0	0	+1\2	1s
2	Helium	1	0	0	+1\2	1s
		1	0	0	-1\2	1s
3	Lithium	1	0	0	+1\2	1s
		1	0	0	-1\2	1s
		2	0	0	+1\2	2s