

Discover of Electron

1. Electron was discovered by J. J. Thomson in Cathode Ray Tube (CRT) experiment.
2. Electrons are negatively charged particles with charge-to-mass ratio $-1.76 \times 10^{-18} \text{ C/gm}$
3. The charge of an electron was measured by R. Millikan in Oil drop experiment.
4. Charge of an electron is $-1.60 \times 10^{-19} \text{ C}$
5. Mass of an electron is $9.1 \times 10^{-28} \text{ gram}$.
6. Electron is approximately 2000 times lighter than hydrogen

Discover of proton

1. A proton is a subatomic particle having a positive charge equal and opposite to that of electron and has a mass of $1.67 \times 10^{-27} \text{ kg}$.
2. It was discovered by Goldstein
3. Charge of proton is $+ 1.6 \times 10^{-19} \text{ C}$
4. The mass of proton is $1.67 \times 10^{-27} \text{ kg}$
5. Charge of one mole of proton is 96500 C

Discover of Neutron

1. It is a neutral subnuclear particle having a mass of $1.675 \times 10^{-27} \text{ kg}$, slightly greater than the mass of proton.
2. It was discovered by Chadwick
3. It is denoted by n
4. The charge of neutron is zero
5. Mass of neutron is $1.675 \times 10^{-27} \text{ kg}$

Bohr-Bury scheme of electronic configuration ($2n^2$) Rule

For 1st shell (K shell) Maximum no of electron is $2 \times 1^2 = 2$

L shell it is $2 \times 2^2 = 8$

M shell it is $2 \times 3^2 = 18$

N shell it is $2 \times 4^2 = 32$

H = 1

He = 2

Li = 2, 1

Be = 2, 2

B = 2, 3

C = 2, 4

N = 2, 5

O = 2, 6

F = 2, 7

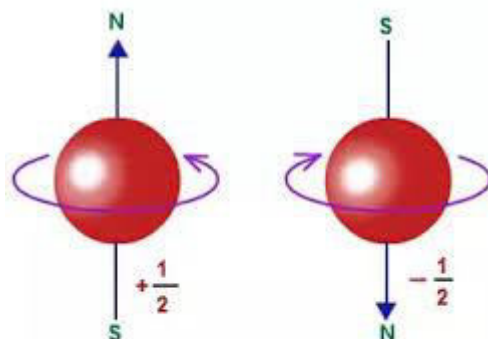
Ne = 2, 8

Quantum numbers

- (1) Principal quantum number (n) The **principal quantum number** (symbolized n) is one of four **quantum numbers** assigned to

all **electrons** in an **atom** to describe that electron's state. Its values are **natural numbers** (from 1) making it a **discrete variable**.

- (2) Azimuthal quantum number(l) The **azimuthal quantum number** is a quantum number for an **atomic orbital** that determines its **orbital angular momentum** and describes the shape of the orbital. The **azimuthal** quantum number is the second of a set of quantum numbers which describe the unique **quantum state** of an electron (the others being the **principal quantum number**, the **magnetic quantum number**, and the **spin quantum number**). It is also known as the **orbital angular momentum quantum number**, **orbital quantum number** or **second quantum number**, and is symbolized as l
- (3) Magnetic quantum number(m) The magnetic quantum number distinguishes the **orbitals** available within a **subshell**, and is used to calculate the azimuthal component of the orientation of orbital in space. Electrons in a particular subshell (such as s, p, d, or f) are defined by values of l (0, 1, 2, or 3). The value of m_l can range from $-l$ to $+l$, including zero. Thus the s, p, d, and f subshells contain 1, 3, 5, and 7 orbitals each, with values of m within the ranges 0, ± 1 , ± 2 , ± 3 respectively.
- (4) Spin quantum number(s). The **Spin Quantum Number** (m_s) describes the angular momentum of an electron. An electron **spins** around an axis and has both angular momentum and orbital angular momentum. Because angular momentum is a vector, the **Spin Quantum Number** (s) has both a magnitude ($1/2$) and direction (+ or -).



electron configuration

The **electron configuration** is the distribution of **electrons** of an **atom** or **molecule** (or other physical structure) in **atomic** or **molecular orbitals**.^[1] For example, the electron configuration of the **neon** atom is $1s^2 2s^2 2p^6$, using the **notation explained below**

Shells and subshells

Electron configuration was first conceived of under the Bohr model of the atom, and it is still common to speak of shells and subshells despite the advances in understanding of the quantum-mechanical nature of electrons.

An electron **shell** is the set of allowed states, which share the same principal quantum number, n (the number before the letter in the orbital label), that electrons may occupy. An atom's n th electron shell can accommodate $2n^2$ electrons, *e.g.* the first shell can

accommodate 2 electrons, the second shell 8 electrons, and the third shell 18 electrons. The factor of two arises because the allowed states are doubled due to electron spin—each atomic orbital admits up to two otherwise identical electrons with opposite spin, one with a spin $+1/2$ (usually noted by an up-arrow) and one with a spin $-1/2$ (with a down-arrow).

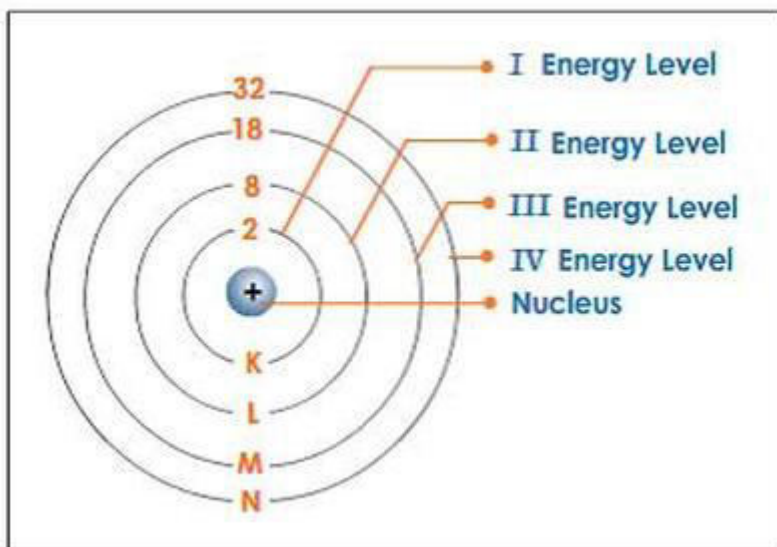
A **subshell** is the set of states defined by a common azimuthal quantum number, ℓ , within a shell. The values $\ell = 0, 1, 2, 3$ correspond to the *s*, *p*, *d*, and *f* labels, respectively. The maximum number of electrons that can be placed in a subshell is given by $2(2\ell + 1)$. This gives two electrons in an *s* subshell, six electrons in a *p* subshell, ten electrons in a *d* subshell and fourteen electrons in an *f* subshell.

The numbers of electrons that can occupy each shell and each subshell arises from the equations of quantum mechanics, in particular the Pauli exclusion principle, which states that no two electrons in the same atom can have the same values of the four quantum numbers.

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 = $2n^2 = 2 \times (4)^2 = 2 \times 16 = 32$

The outermost shell of an atom cannot accommodate more than 8 electrons, even if it has a capacity to accommodate more electrons. This is a very important rule and is also called the Octet rule. The presence of 8 electrons in the outermost shell makes the atom very stable.



Maximum no of electrons in different subshell

S=2

P=6

d=10

f=14

Aufbau order

1S,2S,2P,3S,3P,4S,3d-----

H=1s¹

He=1s²

Li=1s²,2s¹

Be=1s²,2s²

B=1s²,2s²,2p¹

C=1s²,2s²,2p²

N=1s²,2s²,2p³

O=1s²,2s²,2p⁴

F=1s²,2s²,2p⁵

Assignment- Electronic configuration of element from atomic number 11 to 30