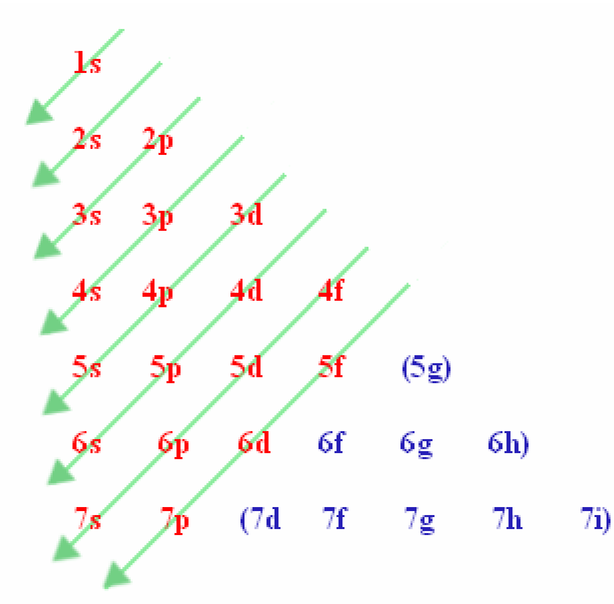
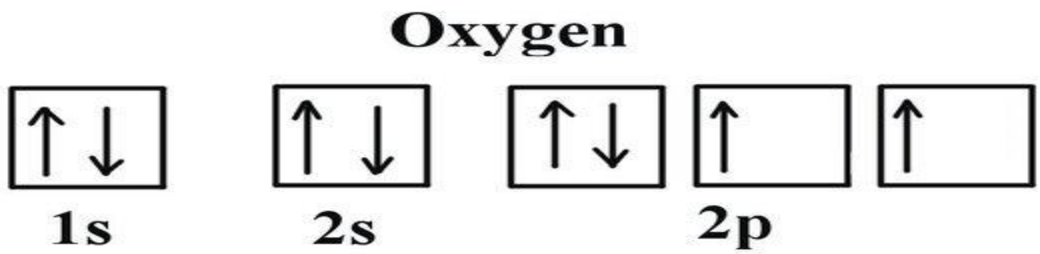


1s, 2s, 2p, 3s, 3p, 4s, 3d, 4p, 5s, 4d, 5p, 6s, 4f, 5d, 6p, 7s, 5f, 6d,7p.

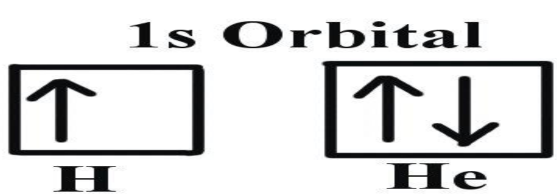
Nots :- that no two electrons in the same atom can have identical values for all four of their quantum numbers.

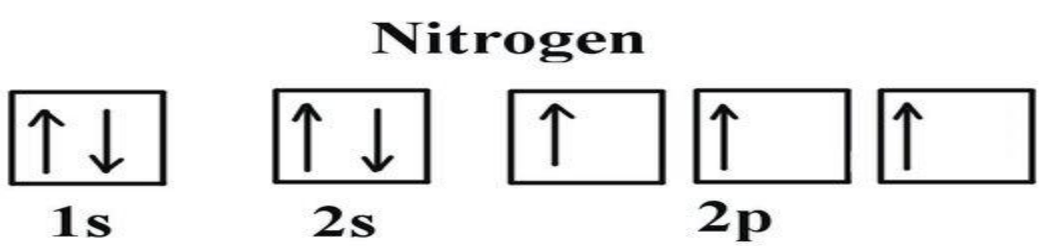
What this means is that no more than **two** electrons can occupy the same orbital, and that two electrons in the same orbital must have **opposite spins**.?



Because an electron spins, it creates a magnetic field, which can be oriented in one of two directions. For two electrons in the same orbital, the spins must be opposite to each other.

s subshell	*p* subshell	*d* subshell	*f* subshell
$\ell = 0$	$\ell = 1$	$\ell = 2$	$\ell = 3$
$m_\ell = 0$	$m_\ell = -1, 0, +1$	$m_\ell = -2, -1, 0, +1, +2$	$m_\ell = -3, -2, -1, 0, +1, +2, +3$
One *s* orbital	Three *p* orbitals	Five *d* orbitals	Seven *f* orbitals
Two *s* orbital electrons	Six *p* orbital electrons	10 *d* orbital electrons	14 *f* orbital electrons

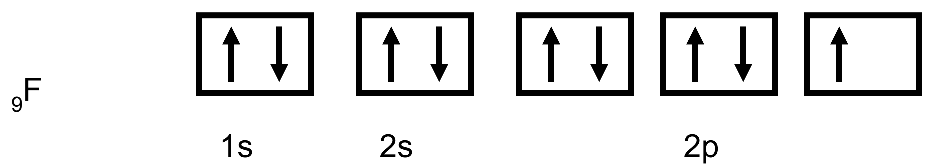




Example: The quantum numbers used to refer to the outer most valence electrons of the Carbon (C) atom, which are located in the 2p atomic orbital, are; n = 2 (2nd electron shell), ℓ = 1 (p orbital subshell), m_ℓ = 1, 0 or −1, m_s = ½ (parallel spins).

Q/ Write a set of quantum numbers for the third electron and a set for the

eighth electron of the F atom



The third electron is in the 2s orbital. Its quantum numbersare

n = l = m_l = m_s=

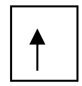
The eighth electron is in a 2p orbital. Its quantum numbers

Table 8.4 Partial Orbital Diagrams and Electron Configurations* for the Elements in Period 4

Atomic Number	Element	Partial Orbital Diagram (4*s*, 3*d*, and 4*p* Sublevels Only)			Full Electron Configuration	Condensed Electron Configuration
		4*s*	3*d*	4*p*		
19	K	↑	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐	$[1s^2 2s^2 2p^6 3s^2 3p^6]\ 4s^1$	$[Ar]\ 4s^1$
20	Ca	↑↓	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐	$[1s^2 2s^2 2p^6 3s^2 3p^6]\ 4s^2$	$[Ar]\ 4s^2$
21	Sc	↑↓	↑ ☐ ☐ ☐ ☐	☐ ☐ ☐	$[1s^2 2s^2 2p^6 3s^2 3p^6]\ 4s^2 3d^1$	$[Ar]\ 4s^2 3d^1$
22	Ti	↑↓	↑ ↑ ☐ ☐ ☐	☐ ☐ ☐	$[1s^2 2s^2 2p^6 3s^2 3p^6]\ 4s^2 3d^2$	$[Ar]\ 4s^2 3d^2$
23	V	↑↓	↑ ↑ ↑ ☐ ☐	☐ ☐ ☐	$[1s^2 2s^2 2p^6 3s^2 3p^6]\ 4s^2 3d^3$	$[Ar]\ 4s^2 3d^3$
24	Cr	↑	↑ ↑ ↑ ↑ ↑	☐ ☐ ☐	$[1s^2 2s^2 2p^6 3s^2 3p^6]\ 4s^1 3d^5$	$[Ar]\ 4s^1 3d^5$
25	Mn	↑↓	↑ ↑ ↑ ↑ ↑	☐ ☐ ☐	$[1s^2 2s^2 2p^6 3s^2 3p^6]\ 4s^2 3d^5$	$[Ar]\ 4s^2 3d^5$
26	Fe	↑↓	↑↓ ↑ ↑ ↑ ↑	☐ ☐ ☐	$[1s^2 2s^2 2p^6 3s^2 3p^6]\ 4s^2 3d^6$	$[Ar]\ 4s^2 3d^6$
27	Co	↑↓	↑↓ ↑↓ ↑ ↑ ↑	☐ ☐ ☐	$[1s^2 2s^2 2p^6 3s^2 3p^6]\ 4s^2 3d^7$	$[Ar]\ 4s^2 3d^7$
28	Ni	↑↓	↑↓ ↑↓ ↑↓ ↑ ↑	☐ ☐ ☐	$[1s^2 2s^2 2p^6 3s^2 3p^6]\ 4s^2 3d^8$	$[Ar]\ 4s^2 3d^8$

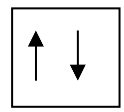
Lithium - 3 electron

Electron configuration $1S^2\ 2S^1$



$n = 2$ $l = 0$ $m_l = 0$ $m_s = +1/2$

Beryllium - four electrons $1s^2\ 2s^2$



n = 2
l = 0
m = 0
s = -1/2

Notice the same n, l, and m values as the third electron, but s has shifted from positive 1/2 to negative 1/2.

Boron - five electrons

Carbon - six electrons

Nitrogen - seven electrons

Oxygen - eight electrons

Fluorine - nine electrons

Neon - ten electrons

Ions

Ions are atoms (or groups of atoms) which carry an electric charge because they have either gained or lost one or more electrons. If an atom gains electrons it a negative charge. If it loses electrons, it becomes positively charged.

Be	$1s^2 2s^2$	**Be^{2+}**	$1s^2$
Mg	$1s^2 2s^2 2p^6 3s^2$	**Mg^{2+}**	$1s^2 2s^2 2p^6$
Al	$1s^2 2s^2 2p^6 3s^2 3p^1$	**Al^{3+}**	$1s^2 2s^2 2p^6$

The electronic structure of s- and p-block ions

Write the electronic structure for the neutral atom, and then add (for a negative ion) or subtract electrons (for a positive ion).

To write the electronic structure for Cl^-:

Cl	$1s^2 2s^2 2p^6 3s^2 3p^5$	but Cl^- has one more electron
Cl^-	$1s^2 2s^2 2p^6 3s^2 3p^6$	

To write the electronic structure for O^{2-}:

O	$1s^2 2s^2 2p^4$	but O^{2-} has two more electrons
O^{2-}	$1s^2 2s^2 2p^6$	

To write the electronic structure for Na^+:

Na	$1s^2 2s^2 2p^6 3s^1$	but Na^+ has one less electron
Na^+	$1s^2 2s^2 2p^6$	

To write the electronic structure for Ca^{2+}:

Ca	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$	but Ca^{2+} has two less electrons
Ca^{2+}	$1s^2 2s^2 2p^6 3s^2 3p^6$	

The electronic structure of d-block ions

Here you are faced with one of the most irritating facts in chemistry at this level When you work out the electronic structures of the first transition series (from scandium to zinc) using the Aufbau Principle, you do it on the basis that the 3d orbitals have a higher energy than the 4s orbital.That means that you work on the assumption that the 3d electrons are added after the 4s ones.However, in all the chemistry of the transition elements, the 4s orbital behaves as the outermost, highest energy orbital. When these metals form ions, the 4s electrons are always lost first.

You must remember this:

When d-block elements form ions, the 4s electrons are lost first.

To write the electronic structure for Cr^{3+}:

Cr	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$
Cr^{3+}	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$

The 4s electron is lost first followed by two of the 3d electrons.

To write the electronic structure for Zn^{2+}:

Zn	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2$
Zn^{2+}	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$

This time there is no need to use any of the 3d electrons.

To write the electronic structure for Fe^{3+}:

Fe	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$
Fe^{3+}	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$

The 4s electrons are lost first followed by one of the 3d electrons

Periodic Table

The periodic table organizes the elements in a particular way. A great deal of information about an element can be gathered from its position in the period table.

For example, you can predict with reasonably good accuracy the physical and chemical properties of the element. You can also predict what other elements a particular element will react with chemically.

Understanding the organization and plan of the periodic table will help you obtain basic information about each of the 118 known elements.

Elements are organized on the table according to their atomic number, usually found near the top of the square.The **atomic number** refers to how many **protons** ,**electron** an atom of that element has.

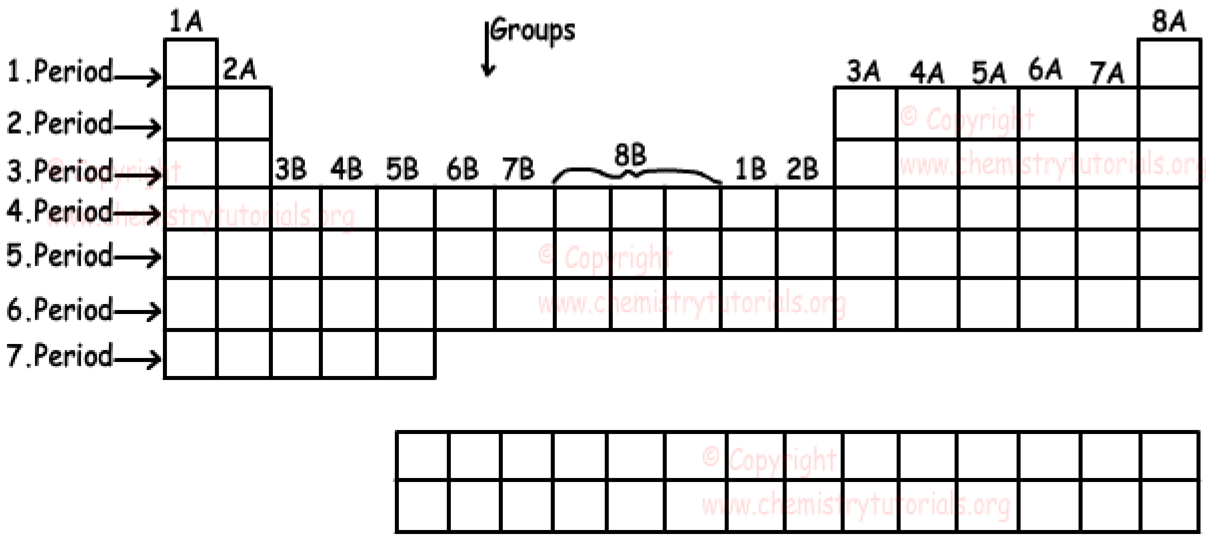
The atomic number is unique to that element. No two elements have the same atomic number

Periodic Table is prepared for classify elements according to their

similarities in chemical and physical properties,in this table,elements

Are ordered to increasing atomic number. General shape of periodic table

is given below:



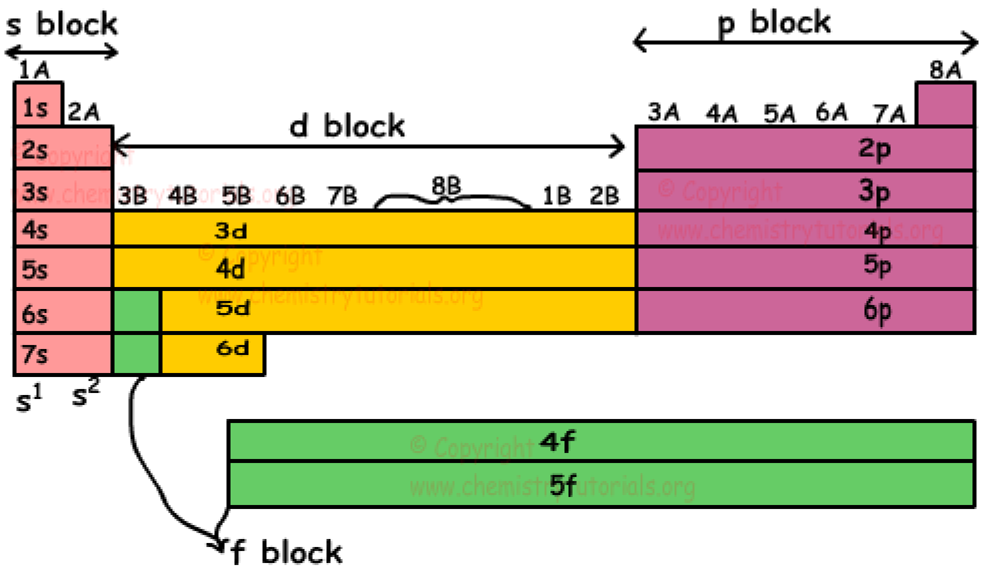
In **Periodic Table** ,you can see atomic number ,name ,symbol and mass number of elements. As you can see from the picture given above .

Horizontal rows are called period(7 period) and ,

Vertical columns are called group(2 group) A&B

group A and group B also have 8 sub group ,in a period properties of elements change from left to right .in a group elements have similar chemical properties.

Orbitals in periodic table



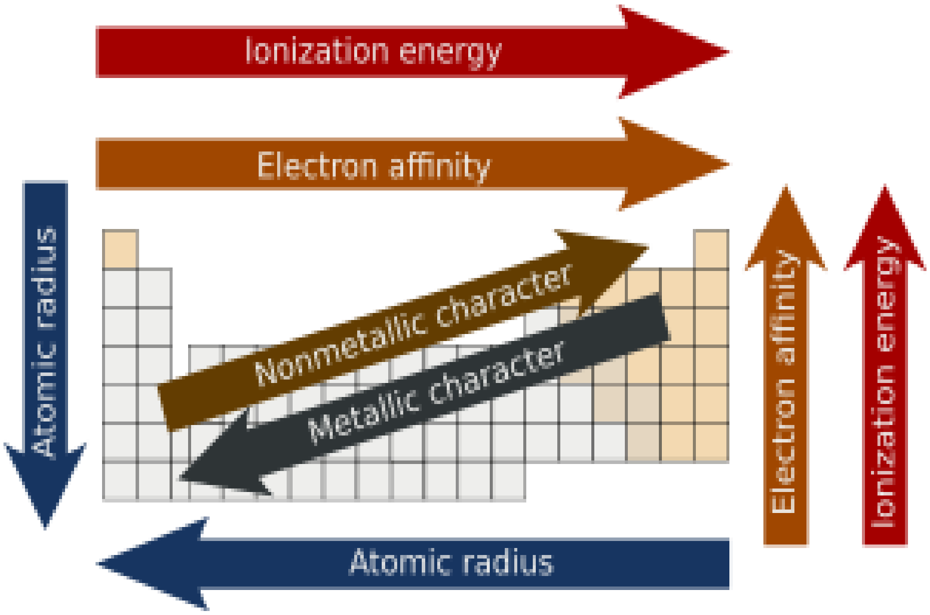
Each orbital can be represented by specific blocks on the periodic table. The s-block is the region of the Alkali metals including Helium (groups 1 & 2), the d-block is the Transition metals (groups 3 to 12), the p-block are the main group elements from group 13 to 18, and the f-block are the Lanthanides and Actinides series.

Periods and Groups

Elements in the periodic table are arranged in periods (rows) and groups (columns). Atomic number increases as you move across a row or period.

Periods

Rows of elements are called periods. The period number of an element signifies the highest unexcited energy level for an electron in that element. The number of elements in a period increases as you move down the periodic table because there are more sublevels per level as the energy level of the atom increases.



Group

Columns of elements help define element groups. Elements within a group share several common properties. Groups are elements have the same outer electron arrangement. The outer electrons are called valence electrons. Because they have the same number of valence electrons(group 1($^{+}$1), elements in a group share similar chemical properties.

Representative Transition Elements

There are two sets of groups. The group A elements are called the representative elements. The group B elements are the non representative elements.

What is on the Element Key?

Each square on the periodic table gives information about an element. On many printed periodic tables you can find an element's symbol, atomic number, and atomic weight.

Elements in the same group tend to show patterns in atomic radius, ionization energy, and electronegativity , Electron affinity.

Chemical Symbols

Each chemical symbol is made up of one or two letters. As new elements are discovered, the person who discovered the element has the privilege of naming it. Name these chemical symbols.

F	**Fluorine**	**B**	**Boron**
Au	**Gold**	**Mn**	**Manganese**
He	**Helium**	**S**	**Sulfur**
Ca	**Calcium**	**Al**	**Aluminum**
Cl	**Chlorine**	**Na**	**Sodium**
O	**Oxygen**	**Cu**	**Copper**

- **Elements in the same group have similar chemical and physical properties!! Why??**

  They have the same number of valence electrons.They will form the same kinds of ions.

Valence Electrons

Valence electrons are the electrons in the outer energy level of an atom.

These are the electrons that are transferred or shared when atoms bond together.

Categories

The elements can be classified according to their shared physical and chemical properties into the major categories of metals, metalloids and nonmetals.

1- Metals are generally located to the left and bottom of the periodic table. They are ordinarily shiny, highly conducting solids which form alloys with one another and salt-like ionic compounds with nonmetals.

2- Nonmetals are located to the right and top. They are mostly colored or colorless insulating gases that form covalent compounds with one another.

3- In between metals and nonmetals are metalloids, which have intermediate or mixed properties.

Notes

Row 1 contains only 2 elements.

Rows 2 and 3 contain 8 elements each.

Rows 4 and 5 contain 18 element each.

Part of Rows 6 and 7 are actually listed below the table to make the table easier to view.

Elements in the same group or family (vertical column) share characteristics. Elements in the same period (horizontal row) have very different properties.

Group 1

- Hydrogen is ***not*** a member, it is a **non-metal**
- 1 electron in the outer shell
- Have valiancy = +1

Group 2

- 2 electrons in the outer shell
- Have valiancy = +2

Groups in the middle

- Good conductors of heat and electricity.

- Some are used for jewelry.
- The transition metals are able to put up to 32 electrons in their second to last shell.
- Can bond with many elements in a variety of shapes.

Group 3

- 3 electrons in the outer shell
- Most are metals
- Boron is a **metalloid**

Group 4

- 4 electrons in the outer shell
- Contains metals, metalloids, and a **non-metal** Carbon (C)

Group 5

- 5 electrons in the outer shell
- Can share electrons to form compounds
- Contains metals, metalloids, and **non-metals**

Group 6

- 6 electrons in the outer shell
- Contains metals, metalloids, and **non-metals**
- Reactive

Group 7

- 7 electrons in the outer shell

- All are **non-metals**
- **Very reactive** are often bonded with elements from Group 1
- Valiancy = -1

Group 8

- Exist as gases
- Non-metals
- 8 electrons in the outer shell = Full
- Helium (He) has only 2 electrons in the outer shell = Full
- Not reactive with other elements
- They valiancy =0

Rare Earth Metals

- Some are Radioactive
- The rare earths are silver, silvery-white, or gray metals.
- Conduct electricity