University of Anbar / College of Education for pure sciences

Department of Chemistry / Vocabulary Theoretical Curriculum of Inorganic Chemistry for the second stage

Curriculum Vocabulary

1 Classification of the periodic table

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3 Hydrogen and its properties

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5 alkaline elements and their compounds

6 Alkaline earth elements, their properties and compounds

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10 elements of the oxygen group, their properties and compounds

11 Elements Halogens Their Properties and Compounds

12 Elements of the noble gases, their properties and compounds

Sources :

Sources Name of the author Publisher

1 Inorganic Chemistry - Second Division Numan Saad Al-Din Al-Nuaimi University of Baghdad

2 Comparative and Synthetic Inorganic Chemistry Moreau and Dawson University of Basra

3 Inorganic Chemistry Issam Zarzis University of Mosul

4 Advanced inorganic chemistry John Wiley and Sons USA

Classification of the Periodic Table

The periodic table consists of vertical lines called groups (groups) and horizontal ones called periods, and there is a third division into Blocks.

a. The groups:-

The modern periodic table is divided into two groups (A, B), and each group includes a number of elements that are similar in their chemical and natural properties.

The group A:-

It contains eight groups

1. The group IA:-

This group includes elements (Li, Na, K, Rb, Cs, Fr) and they are called alkali metals, and these elements are characterized by the state of mono oxidation

2. The group IIA :-

This group includes elements (Be, Mg, Ca, Sr, Ba, Ra) and are known as alkaline-earth metals and their characteristic oxidation state is binary.

3. The group IIIA:-

The group includes (B, Al, Ga, In, Tl) and is characterized by the triple oxidative state.

4, Group IV A:-

This group includes elements (C, Si, Ge, Sn, Pb) and one of the oxidation states characteristic of these elements, the quaternary state.

5. Group V A:-

This group includes elements (N, P, As, Sb, Bi) and from the distinct oxidation states they have the triple and pentagonal states.

6. Group VI A:-

It includes elements (O, S, Se, Te, Po) and is characterized by negative binary and hexadecimal states.

7. Group VII A:-

Elements of this group are known as halogens (F, Cl, Br, I, At).

8. Group VII A:-

The elements of this group are known as the noble gases, which are (He, Ne, Ar Kr, Xe, Rn) and because their electron shells are filled with electrons, their characteristic oxidation state is zero.

Group (B):-

It includes the three series of transition elements and the group of lanthanides and actinides. The elements of this group are also divided into a number of groups (I-VIII) , each group includes elements with similar physical and chemical properties, and the sub group (B) includes all the elements located in the middle of the periodic table.

1	H																			He
2	Li	Be													B	C	N	O	F	Ne
3	Na	Mg													Al	Si	P	S	Cl	Ar
4	K	Ca		Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
5	Rb	Sr		Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
6	Cs	Ba	*	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
7	Fr	Ra	**	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Uub	Uut	Uuq	Uup	Uuh	Uus	Uuo	
			*	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb			
			**	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No			

b. <u>The periodic table consists of seven cycles:</u>

1- The first session: first p.

This cycle includes two components: 2He and 1H, where n = 1 for the 1S outer shell.

2- The second session: second p.

It consists of 8 elements

The outer shell is n = 2 and has the electronic arrangement [He] 2S 2P

3- The third session: third p.

It consists of 8 elements

and the outer shell n = 3 . And it has the electronic arrangement [Ne]10 3S 3P

4- Fourth session: fourth p.

It consists of 18 elements (K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn)

and the outer shell n = 4 . And it has the electronic arrangement [Ar]18 4S 3d 4P

5- The fifth session: the fifth p.

It has 18 elements starting with Rb and ending with Xe and the outer shell n=5 .

And it has the electronic arrangement [Kr]36 5S 4d 5P

6- The sixth session: the sixth p.

It has 32 elements starting with Cs and ending with Rn and the outer shell n=6 .

And it has the electronic arrangement [Xe]54 6S 4f 5d 6P

7- The seventh session: seventh p.

It consists of 32 elements starting with Fr and ending with (Uuo) Ununoctium and the outer shell n=7. And it has the electronic arrangement [Rn]86 7S 5f 6d 7P

* The first, second and third courses are called short courses, while the fourth, fifth, sixth and seventh courses are called long courses.

1- Sector – S Block

It includes two groups (two groups):

The first group is IA and the second group is A II.

2- Sector P Block

It includes six groups:

AIII, AVI, AV, A IV, A IIV, and A IIIV.

* The elements of the S Block and P Blocke are called representative elements because the periodic characteristics of the elements of one cycle are in the same way, i.e. the periodic characteristic changes, increasing or decreasing in all cycles, by increasing the atomic number.

3- Sector d Block

It includes eight groups (ten columns), which are:

group IIIB begins with the element 21Sc

BVI group begins with the element 22Ti

The BV group begins with the element 23V

BIV group begins with element 24Cr

The BIIV group begins with the element 25Mn .

The group BIIIV consists of three columns starting with the elements (26Fe, 27Co, and 28Ni).

Group BI begins with 29Cu .

Group IIB begins with 30Zn

4- Sector - f Block

It includes two series, the Lanthanides, which consist of 14 elements and are one of the elements of the sixth cycle.

The Actanides chain consists of 14 elements and is one of the elements of the seventh cycle.

* The elements of sector d are called the main transition elements, and the elements of sector f are called the inner transition elements.

Group IA (Alkali Metals)

The first group metals, except for hydrogen, are called alkali metals, because these metals when they react with water produce an alkaline solution.

ELEMENT	SYMBOL	ELECTRONIC STRUCTURE
LITHIUM	Li	(He) $2S^1$
SODIUM	Na	(Ne) $3S^1$
POTASSIUM	K	(Ar) $4S^1$
RUBIDIUM	Rb	(Kr) $5S^1$
CESIUM	Cs	(Xe) $6S^1$
FRANCIUM	Fr	(Ra) $7S^1$

Physical properties

Alkaline elements are moderately hard, except for lithium, which is very hard, has a silvery luster, is a good conductor of heat and electricity, has low melting points, and has a central cubic crystalline structure.

Methods of preparing alkali metals:-

Sodium and lithium are prepared by electrolysis of the molten salts, while the rest of the group elements are prepared by the reduction method of their chlorides.

Alkali metal compounds

1- Halides:

2- Alkali metal oxides:

$$2MO_2 + 2H_2O \longrightarrow 2MOH + O_2 + H_2O_2$$

3- Nitrides and Nitrogenous Compounds:

$$6Li + N_2 \xrightarrow{\Delta} 2Li_3N$$

.

$$NaN_3 + Na \xrightarrow[L.]{NH_3} Na_3N$$

$$Na_3N + 3H_2 \longrightarrow 3NaH + NH_3$$

$$3KCl + 4HNO_3 \longrightarrow 3KNO_3 + Cl_2 + NOCl + 2H_2O$$

$$KCl + 2NO_2 \longrightarrow KNO_3 + NOCl$$

4- Sulphides:

It is prepared from the reaction of sulfur with solutions of alkali metals in ammonia liquid.as shown below:-

$$M = Na, K, Rb, Cs$$

$$2M + S \xrightarrow{\Delta} M_2S$$

$$M_2S + S \longrightarrow M_2S_2$$

$$M_2S + 2S \longrightarrow M_2S_3$$

$$M_2S + 3S \longrightarrow M_2S_4$$

$$M_2S + 4S \longrightarrow M_2S_5$$

$$M_2S_5 + S \longrightarrow M_2S_6$$

5- Carbonates

Carbonate of alkaline elements is widely used in industry. Sodium carbonate is prepared by the (Solvay) method, in which carbon dioxide is mixed with a brine of ammonium hydroxide, and the following reactions occur:

$$CO_2 + NH_4OH \leftrightarrow NH_4HCO_3$$

$$NH_4HCO_3 + NaCl \leftrightarrow NH_4Cl + NaHCO_3$$

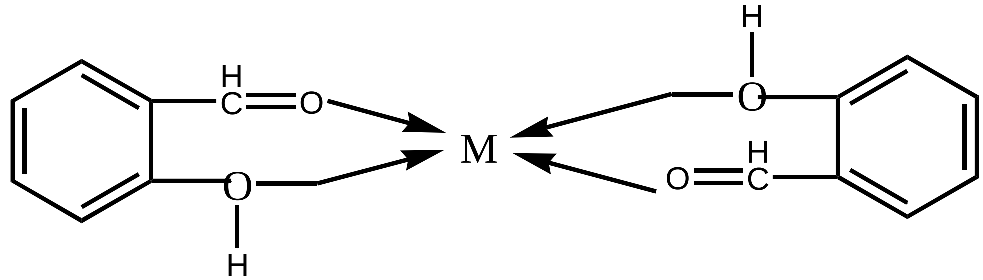
Slightly soluble sodium bicarbonate in this reaction medium is separated, washed, and then heated very hot

$$2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + H_2O + CO_2$$

The carbon dioxide released in the last step is recycled again. The source of carbon dioxide used in this method is from heating limestone rocks to a temperature of (1000) degrees Celsius.

6- Alkali metal complexes:

Coordination complexes are formed by metal ions of small size and high positive charge. Therefore, lithium forms coordination complexes, while the rest of the alkaline elements are not able to form complexes from these few coordination complexes, salicylaldehyde complex:



M = Na , K , Rb , Cs .

Lithium is a coordination complex with the crown ethers, while the rest of the alkali metals cannot form such coordination complexes.

Group IIA (Alkali Earth Metals)

ELEMENT	SYMBOL	Electronic Structure
Berylium	Be	(He) $2S^2$
Magnesim	Mg	(Ne) $3S^2$
Calcium	Ca	(Ar) $4S^2$
Strontium	Sr	(Kr) $5S^2$
Barium	Ba	(Xe) $6S^2$
Radium	Ra	(Rn) $7S^2$

General features:

The properties of some compounds of elements can be shown, starting from calcium towards radium with increasing atomic number, as follows:

A - The ability to hydrate crystallized salts increases.

b - The solubility of elemental halides decreases in ethyl alcohol.

C - The solubility of sulfates, nitrates and chlorides of the elements decreases.

D - The thermal stability of the carbonates, peroxides and nitrates of the elements increases.

E - The rate of the reaction of metals with hydrogen increases.

Different properties of beryllium from other elements:

1- It tends to form covalent bonds due to the high ratio of charge to radius.

2- Beryllium is a toxic element and most of its compounds are very toxic, so great care must be taken when dealing with it.

3- Beryllium is small in size.

4- It exhibits amphoteric behaviour.

5- Beryllium is a complex compound that is more stable than the rest of the elements in the group.

The presence of elements in nature:

One of the most important beryllium ores is Beryl ore [Be3Al2(SiO3)6], which exists in hexagonal crystalline forms. Beryllium is considered one of the rare elements because its available percentage in nature does not exceed 0.0006% of the weight of the earth's crust.

Methods of preparing alkaline elements:-

Calcium:

$6CaO + 2Al \; 3Ca + Ca_3Al_2O_6$

Interactions of Group IIA Elements

1- They combine with halogens to form halides MX_2:

2- It combines with oxygen to form monooxide, MO.

3- It combines with sulfur to form metal sulfide:

4- When the elements of this group are heated with N_2 gas, the metal nitride M_3N_2 is formed:

5- When the elements of this group (other than beryllium) are heated in an atmosphere of H_2 gas, MH_2 . hydrides are formed

6- Reacts vigorously (except for beryllium) with acids releasing H_2 gas:

7- Each of (Ca, Sr, Ba, Ra) reacts with cold water to form hydroxide $M(OH)_2$

As for Be and Mg, they are oxides with water vapor

$Be + H_2O \; BeO + H_2$

8- Beryllium only reacts with dilute hydroxide solutions to release H_2 gas:

9- The elements of this group (except for beryllium) react strongly with nitric acid releasing NO gas:

10- The elements (Ca, Sr, Ba) react with dilute sulfuric acid to form insoluble sulfate and release hydrogen gas:

11- When elements or their oxides are heated with carbon, MC_2 carbides are formed:

Compounds of group IIA elements

1- MH_2 . hydrides

It is formed by direct interaction between the element and hydrogen and is ionic

Except for the element beryllium, it is a covalent hydride when beryllium chloride is reduced with lithium aluminum hydride in an ether solution.

2- Halides MX_2

It is formed by direct reaction between the halogen and the metal $M + X_2$ MX_2 and its characteristics are:

a- All halides are soluble in water except for MF_2, which is sparingly soluble in water.

b - Its ionic character increases with the increase in the atomic number of the element in the group.

3- MO oxides and $M(OH)_2$. hydroxides

The oxides are formed from the carbons of the group elements by thermal dissociation, and the dissociation temperature ranges between

(900-1400) AD.

Among its characteristics:

1- All oxides have an ionic character except for BeO which has a covalent character.

2- All oxides are stable when exposed to air.

3- The basic character of the oxides increases with the increase in the atomic number of the group elements.

4- BeO is inert towards water and MgO does not hydrolyze, but the rest of the oxides of the elements hydrolyze to $M(OH)_2$.

As for hydroxides, they are formed by the reaction between metal oxide and water:

4- Carbides

5 - Carbonate

6- Sulfates

The solubility of MSO_4 in water decreases with the increase in the size of the M^{+2} ion. Therefore, Epsom salt is used

($MgSO_4.7H_2O$) as a laxative because it is very soluble in water. Also, the salt of $2CaSO_4.H_2O$

Plaster of Paris has the ability to absorb water to become $CaSO_4.2H_2O$ with the hardening of the paste, so the paste is used for splinting fractures. As for the sulfates of the elements Ba and Ra, they are insoluble in water and do not contain water of crystallization. Barium sulfate is given to patients to show the stomach when x-rayed.

7- Complex compounds

Uses of alkaline earth elements

Beryllium is currently used in the manufacture of alloys, in particular beryllium benzene alloys with copper. . Its high resistance to electrical conductivity has led to its use in many electrical devices, and magnesium is used as a searchlight in photography and others.

As for calcium, it is used in mining as an agent that removes oxygen and sulfur and to strengthen lead and others. Some strontium compounds are used in sugar purification and in fireworks. Barium is used alone or with aluminum to remove active gases from vacuum tubes.

Third group (AIII)

Boron Group Elements

Element		Electranic Configuration	Oxidn state	Coordn No
Boron	B	{He} $2s^2$ $2p^1$	III	3,4
Aluminum	AI	{Ne} $3s^2$, $3p^1$	(I) III	3,4,6
Gallium	Ga	$[Ar]_{18}$ $3d^{10}$ $4s^2$, $4p^1$	I III	3 ,(4),6
Indium	In	$[Kr]_{36}$ $4d^{10}$ $5s^2$,$5p^1$	I III	3,(4),6
Thallium	Tl	$[Xe]_{54}$ $4f^{14}$ $5d^{10}$ $6s^2$,$6p^1$	I III	3 6

1- Each element has 3 electrons in its outer shell, ns2 np1.

2- The common oxidation state of these elements is (+3 and +1), and this varies according to the element. The common oxidation state for boron and aluminum is (+3) because the energy of ns2 and np1 electrons is approximately equal. In the case of Ga, In, Tl, the energy of ns2 electrons is less than the energy of ns2 electrons. np1 electrons, so it has an oxidation state of (+1) as well as an oxidation state of (+3).

3- The two elements Al and B have a relatively high melting point, while the rest of the elements have lower melting points than

B , Al .

4- The elements Tl, In and Ga have more metallic properties than the elements B and Al.

5- Al differs in some properties from the elements that follow it in the group because of the number of electrons in the penultimate shell (shell 2) is 8 e, while there are 18 e in the penultimate shell of Tl, In, Ga.

6- Most of the compounds formed by boron are covalent.

Boron is the first element in the group and it is in the form of a black crystalline powder, which is a non-metal and is covalent compounds

It is found in nature in the form of Borax, which is widely used in cleaning powders

Boron trioxide B2O3 is heated with Mg powder, one of its most important compounds is borax, Na2B4O7.10H2O, and boric acid H3BO3, which is used as an antiseptic and in the paint industry.

Boron reactions:

1- Boron reacts with O_2 at high temperatures to form B_2O_3.

$4B + 3O_2 \quad 2B_2O_3$

2- It reacts with bases releasing H_2 gas.

$2B + 6NaOH \quad 2Na_2BO_3 + 3H_2$

3- Reacts with acids.

$B + HNO_3 + H_2O \quad H_3BO_3 + NO$

Boron compounds:

1- Sodium borate (borax) $Na_2B_4O_7.10H_2O$

It is a salt of boric acid and when heated it loses its water of crystallization forming anhydrous salt and it has multiple uses, including:

A- It is used as an antiseptic and disinfecting agent for wounds, as the OH^- ions resulting from the hydrolysis of borax are attributed to the disinfecting character.

$Na^+ + BO_2^- + H_2O \quad Na^+ + HBO_2 + OH^-$

B- Borax is added to hard water to remove permanent hardness by forming precipitated salts of Mg and Ca ions.

$Ca^{+2} + 2NaBO_2 \quad 2Na^+ + Ca(BO_2)_2$

C - Auxiliary material in welding metals This characteristic depends on the presence of B_2O_3 in the chemical formula

Borax reacts with basic metal oxides to form easily removable salts.

from the surface of the metal to be welded.

$$CuO + B_2O_3 \longrightarrow Cu(BO_2)_2$$
$$Fe_2O_3 + 3\,B_2O_3 \longrightarrow 2Fe(BO_2)_3$$

2- boron oxide B_2O_3

A white solid, acidic because it dissolves in water, forming boric acid. It can be prepared:

A - from heating boron in the air. $4\,B + 3\,O_2 \quad 2\,B_2O_3$

B- By withdrawing water from boric acid.$2B(OH)_3 \quad 2HBO_2 \quad B_2O_3$

3- Boric acid H_3BO_3

Boric acid is also called orthoboric acid, and it is a weak acid with the chemical formula H_3BO_3, and sometimes it is written in the form $B(OH)_3$ and its composition consists of $B(OH)_3$ units connected to each other by hydrogen bonds in the form of white needle crystals and it is moderately soluble in water.

When heated, it turns into metaboric HBO_2: H_3BO_3 $HBO_2 + H_2O$

When heating continues, B_2O_3 is formed: HBO_2 $B_2O_3 + H_2O$

It can be prepared in two ways:

1- The reaction of boron halides with water

$BCl_3 + 3\ H_2O$ $H_3BO_3 + 3\ HCl$

2- From adding hydrochloric acid to a solution of borax salt

$Na_2B_4O_7 + 5\ H_2O + 2HCl$ $4\ B(OH)_3 + 2\ NaCl$

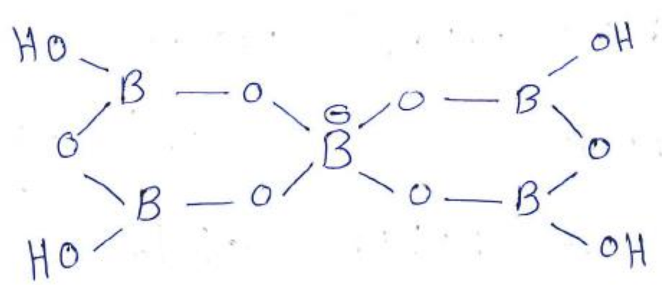
4- Borate

They are salts of boric acid and consist of BO_3^{-3} units, and there are many types of borate that may be hydrated or unhydrated.

hydrated borates such as: potassium borate $KB_5O_8.4H_2O$ and sodium borate $Na_2B_4O_7.\ 10H_2O$

As for the non-hydrated borates, such as: calcium borate CaB_2O_4 and potassium borate $K_3B_3O_6$.

The basic structure of hydrated borates is hexagonal rings, where the anions are formed by bonding two or more rings in the form of a chain, with the participation of the boron atom tetramer and the loss of H_2O.



5- Boron Halides BX_3

All halogens with boron are solid, liquid or gaseous halides of type BX_3, as they are

Boron trifluoride BF_3 in the form of a colorless gas with a pungent odor prepared by heating boron trioxide B_2O_3 with calcium fluoride CaF_2 in the presence of concentrated sulfuric acid. It is considered a strong acid according to

Lewis definition.

Whereas BCl3 is a liquid at room temperature and forms vapors in moist air as a result of its decomposition.

BCl3 + 3H2O H3BO3 + 3HCl

Also, BBr3 is similar to BCl3 in that it is a liquid at room temperature and decomposes in water as follows:

BBr3 + 3H2O H3BO3 + 3HBr

Both BCl3 and BBr3 are prepared from the direct interaction of the elements at high temperatures. Their rapid reaction with water shows that these halides are more acidic than BF3 according to Lewis definition. Therefore, their arrangement according to the acidic character is as follows: BF3 < BCl3 < BBr3

As for BI3, it is a white solid that dissolves in water with a crackle and is prepared by the reaction of iodine with sodium borohydride NaBH4 salt.

6- boron hydrides (boranes)

BnHn+4 BnHn+6

Diborane (6) B2H6 Tetraborane (10) B4H10

Pentaborane (9) B5H9 Liquid Pentaborane (11) B5H11

Hexaborane (10) B6H10 Liquid Hexaborane (12) B6H12

$$2NaBH_4 + H_2SO_4 \longrightarrow B_2H_6 + Na_2SO_4 + 2H_2$$

Fourth group elements (IVA)

Carbon group

ت	العنصر	رمز العنصر	الترتيب الالكتروني	السالبية الكهربائية	نصف قطر التكافؤ
1	الكاربون	$_{6}C$	$[He]2s^{2}2P^{2}$	2.5	0.77
2	السيليكون	$_{14}Si$	$[Ne]3s^{2}3P^{2}$	1.74	1.17
3	الجرمانيوم	$_{32}Ge$	$[Ar]3d^{10}4s^{2}4P^{2}$	2.02	1.22
4	القصدير	$_{50}Sn$	$[Kr]4d^{10}5s^{2}5P^{2}$	1.72	1.40
5	الرصاص	$_{82}Pb$	$[Xe]3f^{14}\ 5d^{10}\ 6s^{2}6P^{2}$	1.55	1.54

The presence of elements in nature and their properties:

Carbon derives its name from the Latin name Garbo, which means coal, and is found in nature in the form of calcium carbonate, $CaCO_3$, which is found in limestone, gravel and chalk.

Carbon is free and pure in two forms: diamond and graphite.

As for silicon, it is found in the form of silica (SiO_2) and silicates such as Na_2SiO_3 and silicon is considered the second most prevalent element in the earth's crust after oxygen.

As for germanium, it is considered one of the rare elements in nature and is found in its ores in the form of germanium sulfate, while tin is found in the form of tin oxide (IVA). As for lead, it is found in the form of lead oxides, and the Egyptians used it in decoration and welding.

The elements of the fourth group have common oxidation states (+2, +4), the oxidation state (+4) is stable for carbon and silicon, while the oxidation state becomes important for germanium and tin, and the most important for lead.

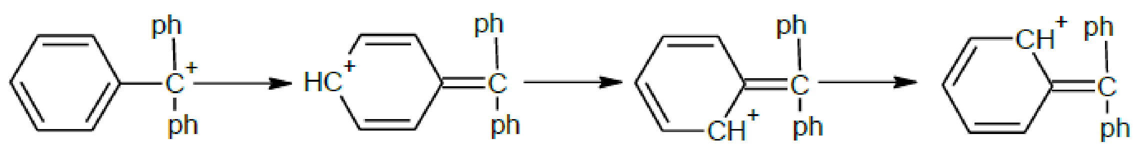
The metallic properties of the group elements increase with the increase in their atomic numbers. Carbon is a metal, while silicon and germanium are semi-metals, while tin and lead show metallic properties.

Carbon differs from the elements of the group by the ease of forming a bond of type (C-C), and there is a decrease in the ability of this group to form a bond of type (M-M), and the elements are listed as follows:

Carbon

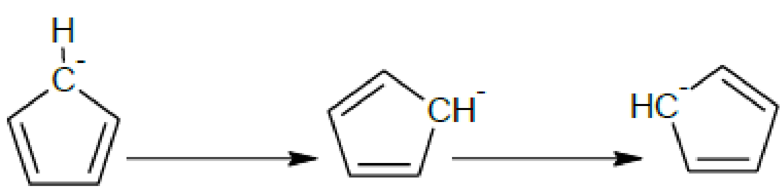
As well as from the positive and negative ions formed by carbon are:

1- The carbonium ion and its general formula is R3C +. The stability of this compound is due to the strong diffusion of the positive charge, as shown by the structures of Triphenyl methyl Carbonium:



2- The carbanion ion and its general formula -R3C, which is not found permanently except in some cases where the negative charge is diffused in an effective way, for example, Carbanion Triphenyl methyl

And Cyclopentadiene, where the negative charge is spread on all carbon atoms.



Carbon isotopes

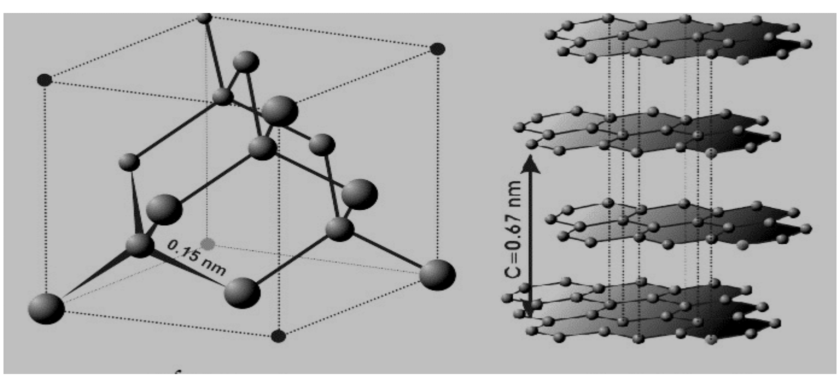
- **C_6 ^{12}**
- **C_6 ^{13}**
- **C_6 ^{14}**

$$_{7}N^{14} + {}_{0}n^{1} \rightarrow {}_{6}C^{14} + {}_{1}H^{1}$$

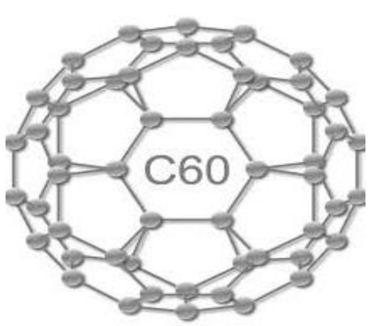
Carbon pictures

Carbon exists in two crystallized forms: diamond, dimond, and graphite, and these forms are considered to be allotropic forms of carbon.

A new form of carbon has recently been discovered, characterized by its high purity and consisting of giant carbon particles. The giant part consists of 60 carbon atoms (C60) and was named after its American discoverer Buckminster Fullerene. It has a circular molecular structure similar to the ball used in the game of football, as it consists of twenty hexagonal rings and twelve five-sided rings, and the carbon atoms are on the vertices of those polygons.



C60 molecules are more flexible than any other known molecules, which is why they are used as fuel for spacecraft and rockets. Where these particles can withstand enormous pressures and when the pressure increases at a tremendous speed, these particles turn into diamonds. These molecules are still under research and study.



Carbon compounds:

1- Carbides

It consists of the union of carbon with the least electrically negative elements of it and it does not include these elements N, P, O, S, and the carbides are prepared in several ways, including:

1- The union of the element with carbon at high temperatures above 2000 °C.

2- The reaction of elemental oxides with carbon at high temperatures.

3- Reaction of the hot metal with a suitable hydrocarbon

There are three types of carbides:

A - ionic carbides.

B - covalent carbides.

C - interstitial carbides.

A - Ionic Carbides: Ionic Carbides

It consists of a combination of the least electronegative metals of carbon and is in the form of colorless and transparent ionic crystals, which are disintegrated by water or dilute acids to release hydrocarbon. It is classified into four

Species:

1- Carbides containing one carbon atom:

Hydrolyzes giving methane as the hydrolysis of Be2C:

$$Be_2C + 4H_2O \longrightarrow 2Be(OH)_2 + CH_4$$

2- Carbides containing two carbon atoms, acetylene:

This group is the most numerous among the rest of the carbides, and is characterized by its formation of acetylene upon hydrolysis.

Alkaline element carbides are prepared from the reaction of acetylene with a solution of the element in ammonia liquid. As for BeC2 and MgC2 they are prepared by heating the metal powder with acetylene at 530 ° C. As for calcium carbide

It is prepared from the reaction of calcium oxide with carbon about (1850-2250) m◦.

3- Carbides containing three carbon atoms:

An example is Al4C3, which gives a methyl acetylene upon hydrolysis:

(C=C=C)-4 + 4H+ CH3C=CH

4- Carbides of the Lanthanes and Actinides:

It has the general formula MC2 and M2C3, thus being similar to alkaline-earth carbides, prepared from

The oxides react with carbon in an electric furnace and hydrolyze, giving hydrogen and acetylene as the main product

With some hydrocarbons.

B- Covalent Carbides

It consists of carbon bonding with covalent bonds with atoms with less electronegativity, for example, boron carbide B4C and silicon carbide (silicone paper) SiC. Boron carbide is prepared commercially by heating boron or its oxide with carbon in an electric furnace, and SiC is prepared in the same way.

SiO2 + 2C Si + 2CO

Si + C SiC

$$SiO_2 + 2C \longrightarrow Si + 2CO$$

$$Si + C \longrightarrow SiC$$

C - Interstitial carbides

Its general form is MC, M_2C

An example of this type is (Ta_2C, TaC, MoC, Mo_2C, VC, V_2C), which is generally prepared by heating metal powder with carbon in isolation from air at 2230 °C.