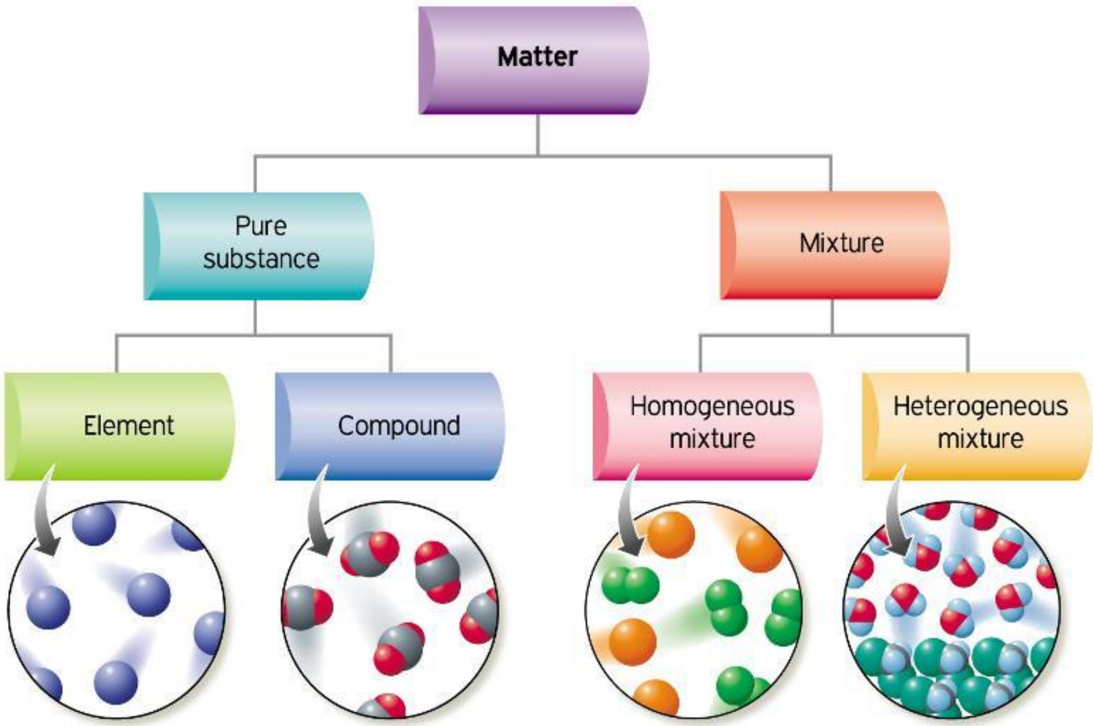
MATTER (2)



Matter is integrated by several substances. Water, copper, oxygen, etc., are substances and we can find these substances in different states: solid, liquid and gaseous. If we want to understand the matter we need to begin with the learning of the easiest state: gaseous state.

1. GASES AND THE STRUCTURE OF MATTER

Sometimes gases are invisible and so this state seems strange, but in the History of Science the knowledge of matter started with the study of the gaseous state.

1.1. Properties of substances in gaseous state

The gaseous state is the simplest one of these three states of matter and shows the greatest uniformity in behaviour. Gases show almost similar behaviour apart from their chemical nature: this property is very different in liquids and solids. Why? Start thinking about this problem.

The gas state is characterized by:

- Gases maintain neither the volume nor the shape. They completely fill the container in which they are placed.
- They expand appreciably when heated.
- Gases are highly compressible. The volume of the gas decreases when the pressure increases.
- They diffuse rapidly into space.
- Gases exert equal pressure in all directions.
- Another characteristic of gases is their **low *densities***, compared with those of liquids and solids. For example, in normal conditions, water vapour occupies 1000 times more volume than liquid water.

We will see later that each of these ***macroscopic*** characteristic of gases follows directly from the ***microscopic*** view (corpuscular nature of matter).

A.1. If a perfume bottle is opened in a corner of a room, you can quickly smell it in any other part of the room. And CFC molecules can destroy the ozone located many kilometers away. What does this fact mean about gases properties?

A.2. Using a plastic syringe you have to research the different behaviour of a gas like air, a liquid like water, or a solid like a piece of chalk by changing the pressure (by increasing or decreasing it) that you apply with your fingers on the piston. Write a short report about this research and give conclusions.

A.3. Using a balloon you have to research the qualitative relationship between the volume of a gas and its temperature. Write a short report about this research and give conclusions.

Gases can change their volume by different causes:

- Changing the pressure: **expansion** is when a gas gets bigger by pressure. The amount of the substance doesn't increase, it just spreads out to occupy more volume. **Expansion** is the opposite of **compression**.
- Changing the temperature: **expansion (dilatation)** is when a gas gets bigger by heat. In this case the opposite of **expansion** is **contraction**.

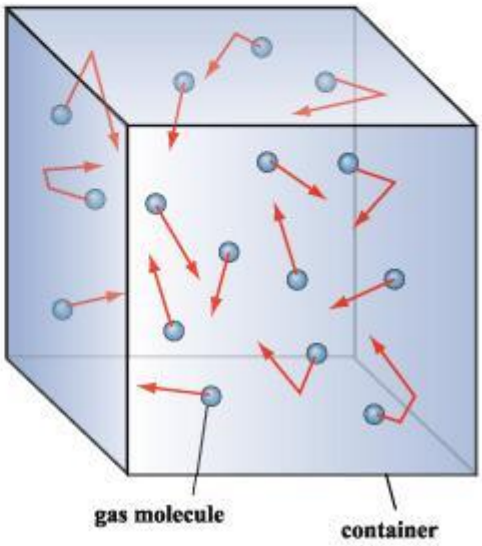
1.2. Kinetic theory of matter

The problem is: how can we understand the behaviour of gases? The first treatment of gases was only **descriptive** but if we want to explain their behaviour we need an **explanatory** one. In general when our aim is to explain different phenomena we need a **theory**. If our problem is to understand the gases we need **the kinetic theory of matter**.

The basic tenets (or postulates) of the **kinetic-molecular theory** are as follows:

- All matter is composed of particles (they can be atoms or molecules).
- The particles of every substance are the same and proper of this substance, obviously different from other particles of other substances, for example in mass.
- Gases are composed of a large number of particles that behave like spherical objects in a state of constant, random motion.
- These particles move along a straight line until they collide with another particle or the walls of the container. These collisions produce pressure in a gas.
- These particles are much smaller than the distance between particles. Most of the volume of a gas is therefore empty space.
- There is no force of attraction between gas particles or between the particles and the walls of the container.
- Collisions between gas particles or collisions with the walls of the container are perfectly elastic. None of the energy of a gas particle is lost when it collides with another particle or the walls of the container.
- The average kinetic energy of a collection of gas particles depends only on the temperature of the gas. When temperature changes particles move at a different speed.

Summary about kinetic theory of gases in flash animation



1.3. Using kinetic theory to understand gases

A.4. **Experimental activity**: you have to dispose two pieces of cotton soaked in concentrated ammonia solution, NH_3 (aq), and concentrated hydrogen chloride solution, HCl (aq), placed at each end of a sealed glass tube, like the picture below, and then answer these questions:

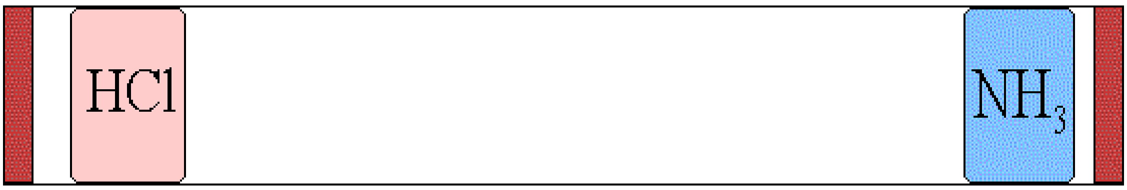
a) What happens?

b) Can you explain this phenomenon using kinetic theory?

c) Why does the white substance appear closer than hydrogen chloride solution?

d) Can your order the mass of molecules involved in this experiment?

e) What is the general conclusion?



A.5. In the following link you can watch a video about bromine (Br_2) diffusion:

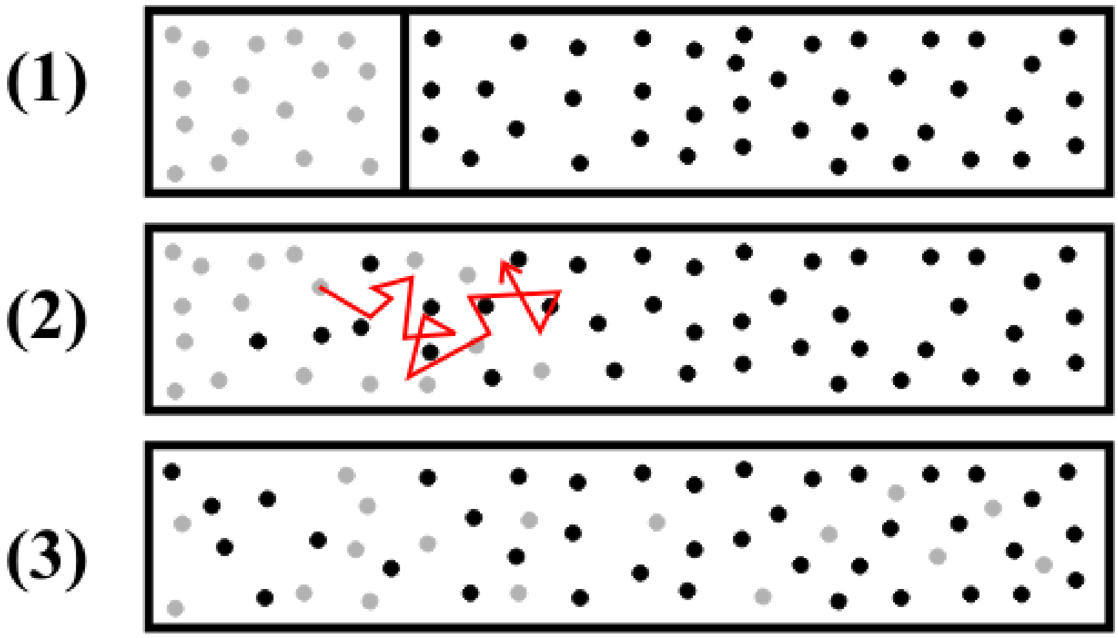
Video

Answer these questions about this video;

a) What is the difference between the first and second experiment?

b) Explain the results of experiments using kinetic theory of gases.

Diffusion is a net transport of molecules from a region of higher concentration to one of lower concentration by random molecular motion. Basically, this phenomenon is caused by the free movement of molecules and it finishes when the concentration of molecules is the same in all container.



A.6. Draw the molecules in normal air, expanded air and compressed air in a syringe as you imagine they are located. What happens with the distance between molecules in these processes? Do you think the size of molecules changes in the three different situations? Why are expansion and compression more difficult in liquid and solid states?

A.7. When you change the position of the piston in the syringe (expansion or compression) it also changes:

a) The total volume of air.

b) The weight of air.

c) The amount of air.

d) The number of molecules.

e) The distance between molecules.

f) The speed of molecules.

g) The size of molecules.

h) The mass of molecules.

i) The chemical composition of air.

Explain your answers.

A.8. You researched using air in a balloon and changing the temperature. Now answer these questions:

a) Why does increasing the temperature of the balloon cause its volume to increase?

b) Why does decreasing the temperature of the balloon cause its volume to decrease?

Explain your answers using the postulates of kinetic theory of gases.

A.9. When you change the temperature of the air in a balloon (expansion or contraction) it also changes:

a) The total volume of air.

b) The weight of air.

c) The amount of air.

d) The number of molecules.

e) The distance between molecules.

f) The speed of molecules.

g) The size of molecules.

h) The mass of molecules.

i) The chemical composition of air.

Explain your answers.

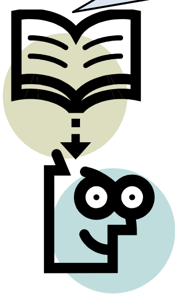
Molecules don’t expand or compress!

Molecules don’t expand or contract!

Molecules don’t change their size or mass!

Molecules change the distance between themselves!

Molecules change their speed only with temperature!



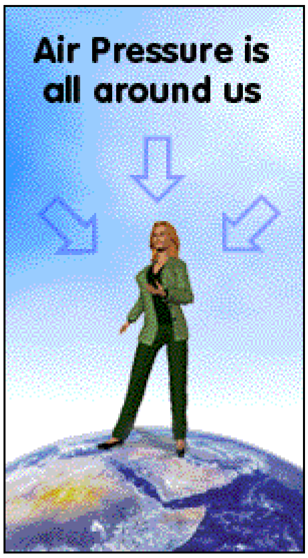
A.10. We studied that pressure is caused by hits of molecules against the wall of the container. What different factors do you think influence on the pressure exerted by a gas?

Atmospheric pressure is the force per unit of area exerted on a body by hits of molecules of air in all directions. There are more of these molecules near the sea level than higher levels because gravity force attracts the air. Therefore, this parameter is maximum at the sea level and decreases until zero when the atmosphere ends.

Air at sea level is what we are used to, in fact, we are so used to it that we forget we are actually feeling air pressure all the time! There is another reason to not feel the enormous amount of hits of molecules: we have air within our body constantly hitting and the final balance can be zero. But, what happens when your ear is blocked and you go up or down quickly, for example in a plane?

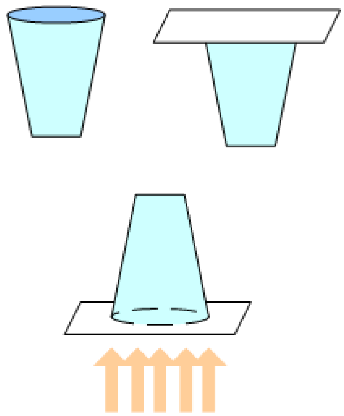
Weather forecasters measure air pressure with a **barometer**. Barometers are used to measure the current air pressure at a particular location in "millimeters of mercury" or in "millibars" (mb). A measurement of 760 millimeters of mercury is equivalent to 1013.25 millibars and this is the normal atmospheric pressure at sea level.

Adapted from this link.



A.11. If you fill totally a glass with water and cover it with a paper sheet, you can turn the glass 180º and water doesn't fall (look at the picture). If the glass contains some air, water will fall down.

Explain this behaviour using the kinetic theory of gases.



A.12. When you heat a can of soft drink with some water and then you put this hot can quickly in cold water (be careful, don't get burnt), what happens?

Explain this experiment using the kinetic theory of gases.

The same as A.12. but much more spectacular in following link:

[**Destroying a wagon!**]

A.13. Using the kinetic theory of gases you should be able to predict the behaviour of a gas in the following situations:

a) What would happen with a gas in a syringe if you increase the pressure without changing the temperature? The same if it decreases.

b) What would happen with a gas in a syringe if you increase the temperature without changing the volume? The same if it decreases.

c) What would happen with a gas in a syringe if you increase the temperature without changing the pressure? The same if it decreases.

d) What would happen with a gas in a balloon if you increase the amount of molecules without changing the temperature? The same if it decreases.

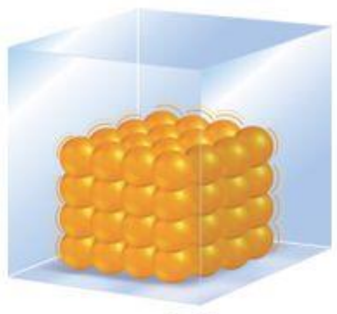
Compare your answers with the next flash animations.

1.4. Kinetic theory of solid and liquid states

We can extend the kinetic theory of gases to liquid and solid states assuming new ideas. Summarizing:

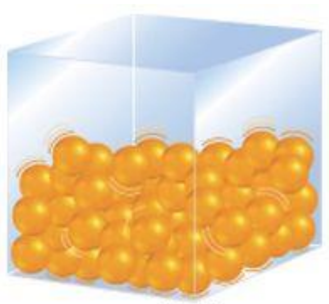
Solid state:

- Particles are close together, slowly vibrating.
- Rigid, geometric arrangement.
- Fixed volume and shape.
- Intense attractive forces between particles: molecules cannot get separated.



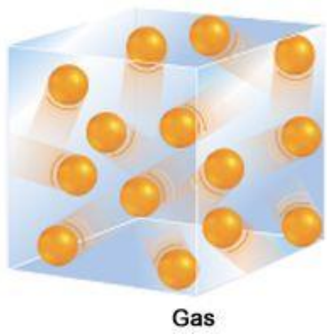
Liquid state:

- Particles have more kinetic energy than they did in the solid state (vibrating faster).
- Particles can slip and slide past one another, but not separate.
- Fixed volume.
- Flow to change shape (they can take on the shape of the container).
- Attractive forces have, more or less, the same intensity than solid but the particles move quickly.



Gas state:

- Particles have even more kinetic energy than they did in the liquid state.
- Particles can move far away from each other.
- No fixed volume or shape.
- Highly compressible.
- Attractive forces are almost non-existent and overcome by the speed of molecules: it is not possible to join them in a liquid state.



A.14. Using the kinetic theory, answer these questions:

a) Why do solid and liquid states have much less compressibility than gas state?

b) Does solid state have diffusion? Why?

c) Why does solid state have fixed volume and shape?

d) Why does liquid state have fixed volume but the shape can change?

e) Why does gas state have no fixed volume and shape?

f) Why can gases and liquids flow but not solids?

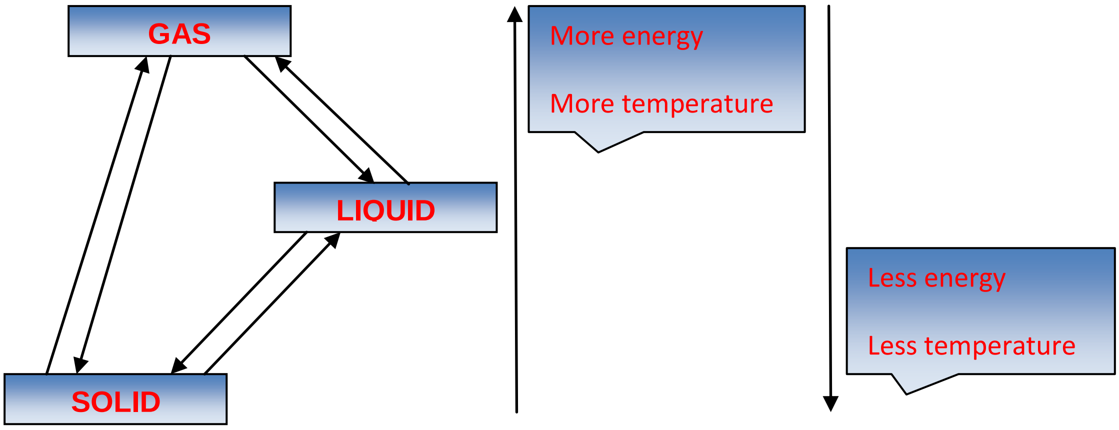
g) Is it possible to transform a gas into a liquid by means of pressure?

h) Is it possible to transform a liquid into a solid by means of pressure?

To understand expansion and contraction in solids see next link.

1.5. Kinetic theory and changes of state

A.15. In the diagram below you have to complete the name of every change of state using the following list: melting, condensation, vaporization (boiling), reverse sublimation, solidification (freezing), sublimation.



A.16. a) Explain every change of state using the kinetic theory of matter.

b) Why does every change of state always happen at the same and characteristic temperature?

c) What is the meaning of this temperature of change of state?

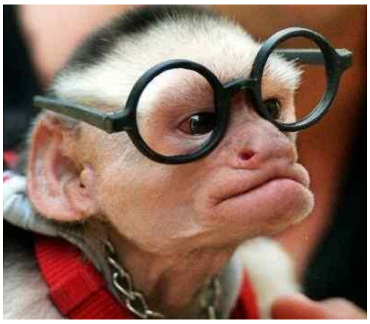
d) During the change of state, the temperature is constant, can you explain this strange fact?

e) What do you think about attractive forces in molecules of substances that experiment sublimation, like for example iodine?

A.17. Vaporization is not the same phenomenon as evaporation. Explain the differences between both concepts. Why can you dry your clothes by air if the water is not boiling?

A.18. Why do we sweat a lot if we have a high temperature? Explain this fact using the kinetic theory of matter.

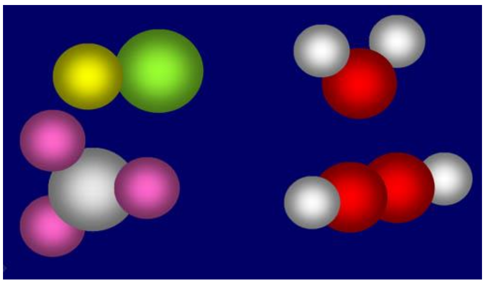
You can review all you have learnt until now in the next summary in PowerPoint.



2. ATOMIC THEORY

In the first part of the unit we studied how kinetic theory can explain physical changes very well, but to understand chemical changes we need another theory, the atomic theory. A simplified model, according to our limited interests, can have the next postulates:

- All the substances are composed of little particles.
- These particles can be atoms or molecules.
- A molecule is a group of atoms united by chemical bonds.
- The properties of substances depend on the type and arrangement of atoms and molecules.
- A simple substance has only one type of atoms although they can be organized in different arrangements.
- A compound substance always has different types of atoms in its molecules, at least two types.



A.19. There are only 90 kinds of atoms in nature (there are more artificials):

a) How many simple substances do you think there would be (estimate them only)? Remember, the same kind of atoms can be arranged in different forms.

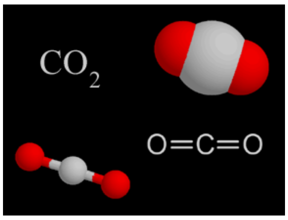
b) How many compound substances do you think there would be (estimate them only)?

In the next link you can know the number of chemical compounds studied by chemists until right now.

To represent molecules we use formulae. **Formula** shows the number, with **subscripts**, and types of atoms, with **chemical symbols**, in a substance.

Substance	Formula	Type of substance	Meaning
Water	H_2O	Compound	Every molecule is integrated by 2 atoms of hydrogen and 1 atom of oxygen.
Ozone	O_3	Simple	Every molecule is integrated by 3 atoms of oxygen.
Sulphur	S_8	Simple	Every molecule is integrated by 8 atoms of sulphur.
Hydrogen chloride	HCl	Compound	Every molecule is integrated by 1 atom of hydrogen and 1 atom of chloride.
Carbon dioxide	CO_2	Compound	Every molecule is integrated by 2 atoms of oxygen and 1 atom of carbon.

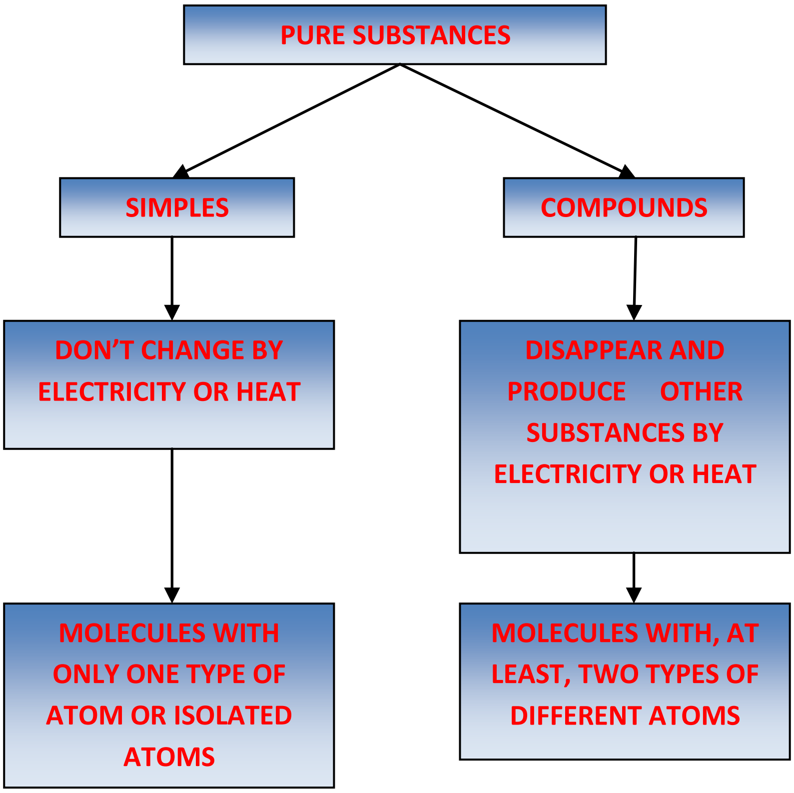
A.20. Make a similar table with the next formulae, looking for information about the name of substances: NH_3, H_2SO_4, $C_6H_{12}O_6$, P_4, C_2H_6O, N_2, NaCl, Au.



A.21. Using formulae and information about aggregation state between brackets, draw how you imagine, at microscopic level, the next substances: Hg (l), CaO (s), Br_2 (l), CH_4 (g), CO_2 (g).

Use little circles of different colours to represent different kinds of atoms.

Summarizing:

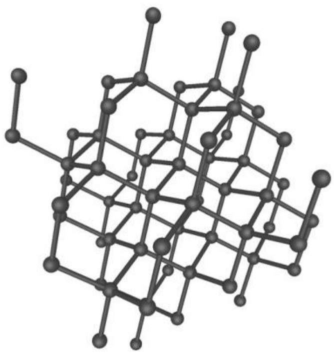
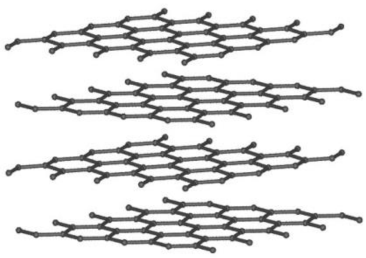


2. 1. Atomic-molecular structure and macroscopic properties

Atomic-molecular structure determines macroscopic properties. A little change in a molecular organization can produce a very big change in physical and chemical properties of a substance. This idea permits us to understand how enormous changes in a chemical reaction can occur: a little change in atoms or their numbers produce different molecules and therefore different substances. Now some examples:

Substance	Formula	Properties
Atomic oxygen	O	Gas; very reactive; dangerous for us.
Molecular oxygen	O_2	Gas; moderately reactive: we can't live without this substance.
Ozone	O_3	Gas; ozone is corrosive, a strong oxidant and very toxic for us.
Chlorine	Cl_2	Greenish yellow gas; highly poisonous.
Sodium	Na	Weak metal; explosive with water.
Sodium chloride	NaCl	White solid salt; we can't live without this substance.
Diamond	C (three-dimensional)	One of the hardest substances; transparent; electric insulator.
Graphite	C (laminated)	Black weak solid; conducts electricity very well.



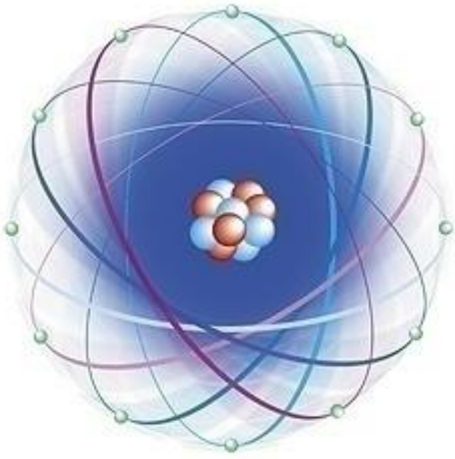
A.22. In graphite, carbon atoms that are between layers are more separated than in diamonds. Do you think it would be possible to transform graphite into a diamond? How could we make a diamond from your pencil point?

Think about this problem and afterwards you can see the next curious link:

http://lifegem.com/

2. 2. Atoms properties

When we think about atoms we usually imagine a little marble. But the real situation is more complicated because atoms have a structure: inside there are other subatomic particles with some important physicall properties like mass or electric charge.



A.23. Look for information and write a report about the next questions:

a) How many subatomic particles are there?

b) How are they disposed in atoms?

c) What is the main difference between every kind of atom?

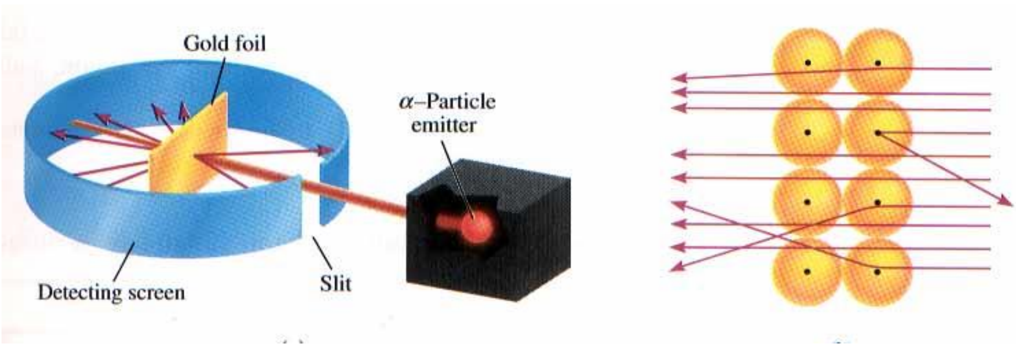
d) What are ions? How many types of ions are there?

At the end of your research see the next links:

Atom helium in flash animation.

About this atomic model (Rutherford's model).

Basic atomic structure video.



Atoms properties

Atomic number

Each element has a unique number of protons in its atoms. This number is called the atomic number (abbreviated **Z**). Because atoms are normally electrically neutral, the atomic number also specifies how many electrons of an atom there will be. The number of electrons determines many of the chemical and physical properties of the atom.

Mass number

The total number of protons and neutrons in the nucleus of an atom is the mass number of the atom (abbreviated **A**). The mass number of an atom is an approximation of the mass of the atom. The electrons give little contribution to the mass of the atom, so they are not included in the mass number.

Isotopes

When two atoms have the same atomic number but different mass number, they are **isotopes**.

Atomic Mass and Weight

Scientists usually measure the mass of an atom in terms of a unit called the atomic mass unit (abbreviated **amu**). They define an amu as exactly 1/12 the mass of an atom of carbon with six protons and six neutrons. On this scale, the mass of a proton is 1.00728 amu and the mass of a neutron is 1.00866 amu. The mass of an atom measured in amu is nearly equal to its mass number (A).

A.24. Complete the following table. What is the relationship between the first three atoms? And between the last two atoms?

Look for information on the internet about the three hydrogen isotopes.

Symbol	Electric charge	A	Z	number of protons	number of electrons	number of neutrons
H			1			0
		2	1			
H						2
H	- 1					0
	+ 1	1		1		
Mg	+ 2	26		12		
S	- 2		16			18
Cl		35		17		
				17		20

2. 3. Atomic and molecular masses.

The **atomic masses** of which we spoke in the previous section are those that we can find in the periodic table and refer to atoms. **Molecular mass or molecular weight** is the mass of a molecule. It is calculated as the sum of the atomic weights of each constituent element multiplied by the number of atoms of that element in the molecular formula.

A.25. Looking information in your periodic table, answer these questions:

a) What are the atomic masses of the atoms of H, C, O and S?

b) What are the molecular masses of the molecules of H_2O, CO_2, H_2CO_3, H_2SO_4, CH_4 and C_4H_{10}?

Row	Group I	Group II	Group III	Group IV	Group V	Group VI	Group VII	Group VIII
1	H = 1							
2	Li = 7	Be = 9	B = 11	C = 12	N = 14	O = 16	F = 19	
3	Na = 23	Mg = 24	Al = 27	Si = 28	P = 31	S = 32	Cl = 35.5	
4	K = 39	Ca = 40	Sc = 44	Ti = 48	V = 51	Cr = 52	Mn = 55	Fe = 56 Co = 58.5 Ni = 59
5	Cu = 63	Zn = 65	Ga = 70	Ge = 72	As = 75	Se = 79	Br = 80	
6	Rb = 85	Sr = 87	Y = 89	Zr = 90	Nb = 94	Mo = 96		Ru = 103 Rh = 104 Pd = 106
7	Ag = 108	Cd = 112	In = 113	Sn = 118	Sb = 120	Te = 125	I = 127	
8	Cs = 133	Ba = 137	La = 138	Ce = 140				
9								
10			Yb = 173		Ta = 182	W = 184		Os = 191 Ir = 193 Pt = 196
11	Au = 198	Hg = 200	Tl = 204	Pb = 206	Bi = 208			
12				Th = 232		U = 240		

2. 4. Periodic table of elements

A.26. Read the article about History of the periodic table in Wikipedia and answer these questions:

a) What is the periodic law?

b) What was the criterion for the first classification of elements made by Lavoisier?

c) How many elements and groups were established by John Newlands in 1865?

d) What was the criterion to Mendeleev's table?

e) What was the main benefit of Mendeleev's table?

f) In the picture above (Mendeleev's table) try to recognize differences and similarities with the current periodic table.

g) Who was Lothar Meyer? Why was Mendeleev more famous than him if their tables were "virtually identical"?

h) What was the definitive criterion to the current periodic table? Who was its discoverer? What kind of research was he doing?

A.27. Seeing the current periodic table answer these questions:

a) Research the meaning of these words: metals; non-metals; metalloids; alkali; alkali earth; halogens; noble gases; transition elements; inner transition elements; lanthanides; actinides; decay elements; synthetic elements; group; period.

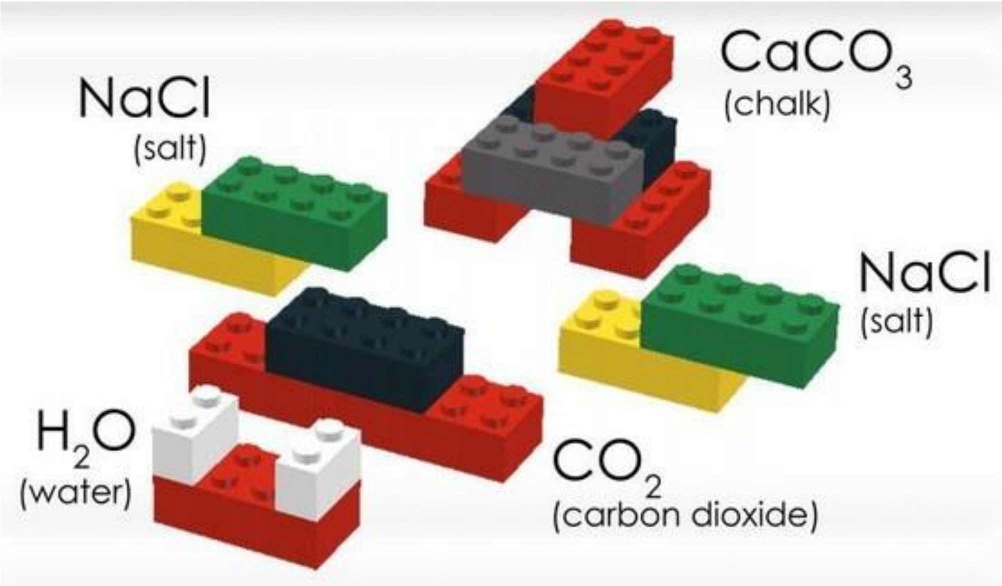
b) How many elements are solid in standard conditions.

c) How many elements are liquid in standard conditions.

d) How many elements are gaseous in standard conditions.

3. ATOMS, MOLECULES AND CRYSTALS

A.28. How many substances could there be in nature if each were made up of only one type of atoms?



A.29. Why are there actually millions of different substances?

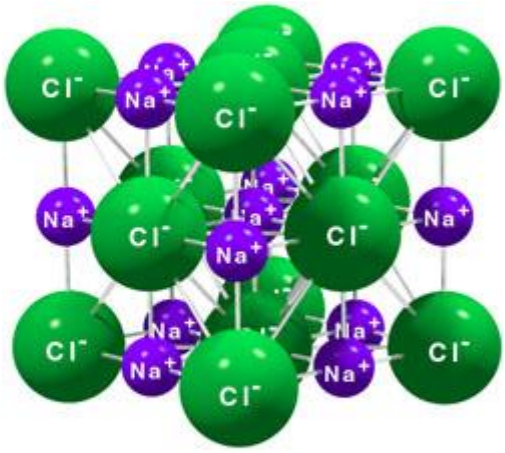
A.30. In the following video you can see a summary of what we have studied about atomic structure and also explains the concept of molecule. Watch the video and answer the next questions:

a) What is a chemical bond?

b) What are the main types of chemical bonds?

c) Define the concept of molecule.

A **crystal** or crystalline solid is a solid material whose constituents (such as atoms, molecules, or ions) are arranged in a highly ordered microscopic structure, forming a **crystal lattice** that extends in all directions. In addition, macroscopic single crystals are usually identifiable by their geometrical shape, consisting of flat faces with specific, characteristic orientations.



Crystal salt lattice

4.ELEMENTS AND COMPOUNDS OF SPECIAL INTEREST WITH INDUSTRIAL, TECHNOLOGICAL AND BIOMEDICAL APPLICATIONS

A.31. Look for information about at least five elements and compounds of special interest with industrial technological and biomedical applications. Write a report explaining the interest of each of them.

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http://www.mhhe.com/physsci/chemistry/essentialchemistry/flash/gasesv6.swf

http://www.mhhe.com/physsci/chemistry/essentialchemistry/flash/ruther14.swf

https://www.slideshare.net/EdiSon/kinetic-model-of-matter

https://www.youtube.com/watch?v=lP57gEWcisY

https://www.youtube.com/watch?v=kPgqJFFiLUc

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https://www.youtube.com/watch?v=ZAGloLXO9L0

https://www.youtube.com/watch?v=l1VXM_b2KFY

https://www.wisc-online.com/learn/natural-science/chemistry/gch4904/the-kinetic-theory-of-gases

APPENDIX 1: GENERAL VOCABULARY OF THE UNIT

Actually	/ˈæktʃʊəlɪ/	Realmente, de hecho
Ammonia	[ə'məʊnɪə]	Amoníaco
Arrangement	/ə'reɪndʒmənt/	Disposición, configuración
Barometer	/bə'rɑ:mətər / /bə'rɒmɪtə(r)/	Barómetro
Beam	/bi:m/	Viga
Bromine	/ˈbrəʊmiːn/	Bromo
Chalk	/tʃɔ:k/	Tiza
Can	/kæn/	Lata, bote, tarro
Charge	/tʃɑ:rdʒ /	Carga
Chemical bond	/ˈkɛmɪkəl bɒnd/	Enlace químico
Chloride	/ˈklɔː.raɪd/	Cloruro
Chlorine	/'klɔ:ri:n/	Cloro
Collide	[kə'laɪd]	Colisión, choque
Compressible	/kəmˈpres.ɪ.bl̩/	Comprimible
Container	/kən'teɪnər /	Recipiente
Copper	/'kɑ:pər / || /'kɒpə(r)/	Cobre
Crystal lattice	/ˈkrɪstəl ˈlætɪs/	Red cristalina
Crystalline	/ˈkrɪs.tᵊl.aɪn/	Cristalino/a
Descriptive	/dɪ'skrɪptɪv/	Descriptivo/a
Explanatory	/ɪk'splænətɔ:ri /	Explicativo/a
Graphite	['græfɪt]	Grafito
Heterogeneous	[hetərəʊ'dʒɪ:nɪəs]	Heterogéneo/a
Homogeneous	/'həʊmə'dʒi:niəs/	Homogéneo/a
Identifiable	/aɪˌdentɪˈfaɪəbl/	Identificable
Iodine	/'aɪədaɪn / ||/'aɪədi:n/	Yodo
Ion	/'aɪən/	Ion
Irrespective	/'ɪrɪ'spektɪv/	Independientemente
Knowledge	/'nɑ:lɪdʒ / || /'nɒlɪdʒ/	Conocimiento
Macroscopic	/makrə'skɒpɪk/	Macroscópico/a
Microscopic	/maɪkrə'skɒpɪk/	Microscópico/a
Marble	/'mɑ:rbəl /	Mármol, canica

Mixture	/'mɪkstʃər /	Mezcla
Mysterious	/mɪ'stɪriəs / ||/mɪ'stɪəriəs/	Misterioso/a
Nail	/neɪl/	Clavo
Neither…nor	/'naɪðə(r)/	Ni…n i
Perfume	/'pɜ:rfju:m /	Perfume
Petrol	/'petrəl/	Gasolina
Petroleum	/pə'trəʊliəm/	Petróleo
Phenomena	[fɪ'nɒmɪnə]	Fenómenos
Phenomenon	[fɪ'nɒmɪnən]	Fenómeno
Piston	/'pɪstən/	Émbolo, pistón
Poisonous	/'pɔɪzn̩əs/	Venenoso
Pole	/pəʊl/	Polo
Qualitative	['kwɒlɪtətɪv]	Cualitativo/a
Quantitative	['kwɒntɪtətɪv]	Cuantitativo/a
Random	/'rændəm/	Aleatorio/a
Seemingly	['sɪ:mɪŋlɪ]	Aparentemente
Shape	/ʃeɪp/	Forma
Size	/saɪz/	Tamaño, dimensión
Sodium	/'səʊdiəm/	Sodio
Soft drink	/sɒft//drɪŋk/	Refresco
Spherical	/'sfɪrɪkəl /	Esférico/a
Steam	/sti:m/	Vapor
Summary	/'sʌməri/	Resumen
Syringe	/sə'rɪndʒ / || /sɪ'rɪndʒ/	Jeringa
Technique	/tek'ni:k/	Técnica
Tenet	/'tenət / || /'tenɪt/	Principio
Theory	/'θiəri/	Teoría
Therefore	/'ðeəfɔ:(r)/	Por lo tanto, por consiguiente
To achieve	/ə'tʃi:v/	Lograr, conseguir
To assume	/ə'sju:m/	Suponer, asumir
To attract	/ə'trækt/	Atraer
To burn	/bɜ:rn /	Quemarse, arder
To collide	/kə'laɪd/	Colisionar, chocar

To diffuse	/dɪ'fju:z/	Difundirse
To dry	/draɪ/	Secar
To exert	/ɪg'zɜ:rt / || /ɪg'zɜ:t/	Ejercer
To flow	/fləʊ/	Fluir
To involve	/ɪn'vɒlv/	Implicar, involucrar
To join	/dʒɔɪn/	Unir, juntar
To make up	/meɪk/	Configurar
To refer	/rɪ'fɜ:r /	Referir, remitir
To refine	/rɪ'faɪn/	Refinar
To satisfy	/'sætəsfaɪ / || /'sætɪsfaɪ/	Satisfacer
To seal	/si:l/	Cerrar, precintar, lacrar
To slide	/slaɪd/	Deslizarse
To slip	/slɪp/	Resbalar
To soak	/səʊk/	Empapar, poner en remojo
To spread out	/spred/	Extenderse, desplegarse
To sweat	/swet/	Sudar
To undergo	/'ʌndər'gəʊ /	Experimentar, sufrir
Vapour	/'veɪpər /	Vapor
Vegetation cover	/'vedʒə'teɪʃən //'kʌvər /	Cubierta vegetal
Virtually	/'vɜ:rtʃuəli /	Prácticamente, casi
Wagon	/'wægən/	Vagón
Weak	/wi:k/	Débil, endeble, flojo

APPENDIX 2: SPECIFIC VOCABULARY OF THE UNIT

Density /'densəti/ Density is a property of a substance that can be measured, and every substance has a different density. Density is the mass of the substance divided by the volume occupied by the substance.	**Densidad**
Expansion /ɪk'spænʃən/ Expansion is when a gas gets bigger by pressure or heat (in this case we can also use dilatation).	**Expansión**
Simple substance /'sɪmpəl/ /'sʌbstəns/ Substance that you can't decompose by heat or electricity.	**Sustancia simple**
Compound substance /'kɒmpaʊnd//'sʌbstəns/ Substance that you can decompose by heat or electricity.	**Sustancia compuesto**
Atomic theory /ə'tɒmɪk//'θiəri/ In chemistry and physics, atomic theory is a theory of the nature of matter, which states that matter is composed of discrete units called atoms or molecules.	**Teoría atómica**
Compression [kəm'preʃən] Compression is when a gas gets smaller by pressure.	**Compresión**
Contraction /kən'trækʃən/ Contraction is when a gas gets smaller by cooling.	**Contracción**
Kinetic theory /kɪˈnet.ɪk/ /ˈθɪə.ri/ Model about matter that permits to understand macroscopic properties of matter assuming some simple microscopic ideas.	**Teoría cinética**

Diffusion /dɪˈfjuː.ʒᵊn/ Diffusion is a net transport of molecules from a region of higher concentration to one of lower concentration.	**Difusión**
Pressure /'preʃər / Pressure is measured in units of force applied per unit of area. Pressure is exerted uniformly in all directions.	**Presión**
Atmospheric pressure /'ætməs'ferɪk/ Atmospheric pressure is the force per unit of area exerted on a body by hits of molecules of air in all directions.	**Presión atmosférica**
Melting /meltɪŋ/ Change of state from solid to liquid.	**Fusión**
Solidification /səˌlɪd.ɪ.fɪˈkeɪ.ʃᵊn/ Change of state from liquid to solid (also named freezing).	**Solidificación**
Vaporization /ˈveɪ.pᵊr.aɪzeɪ.ʃᵊn/ Change of state from liquid to gas (also named boiling).	**Vaporización**
Condensation /ˌkɒn.denˈseɪ.ʃᵊn/ Change of state from gas to liquid.	**Condensación**
Sublimation /ˌsʌb.lɪˈmeɪ.ʃᵊn/ Change of state from solid to gas.	**Sublimación**
Reverse sublimation /rɪ'vɜ:rs / Change of state from gas to solid.	**Sublimación inversa**
Atomic number /ə'tɒmɪk//'nʌmbər / The order of an element in Mendeleyev's table of the elements; equal to the number of protons in the nucleus or electrons in the neutral state of an atom of an element.	**Número atómico**

Mass number /mæs//ˈnʌmbər / The sum of the number of neutrons and protons in an atomic nucleus.	**Número másico**
Atomic mass /əˈtɒmɪk//mæs/ The mass of an atom of a chemical element expressed in atomic mass units.	**Masa atómica**
Atomic mass unit /əˈtɒmɪk//mæs//ˈju:nɪt/ The precise definition is that it is one twelfth of the mass of an isolated atom of carbon-12 (^{12}C).	**Unidad de masa atómica**
Periodic table of elements /ˈpɪəriˈɒdɪk//ˈteɪbəl//ˈeləmənts / The periodic table of the chemical elements is a tabular display of the chemical elements based in periodic law: chemical properties of the elements are periodic functions of their atomic numbers.	**Tabla periódica de los elementos**
Characteristic properties /ˈkærəktəˈrɪstɪk/ Typical properties of a substance. They serve to recognize this substance.	**Propiedades características**
Heterogeneous material [hetərəʊˈdʒɪ:nɪəs] /məˈtɪriəl / Material with different characteristic properties in different points.	**Material heterogéneo**
Homogeneous material /ˈhəʊməˈdʒi:niəs //məˈtɪriəl / The same characteristic properties in all the points.	**Material homogéneo**
Metal /ˈmetḷ/ Any of the several chemical elements that are usually shiny solids that conduct heat or electricity and can be formed into sheets and other specific properties.	**Metal**

Non-metal /nɒn//'metḷ/ A non-metal is a substance that conducts heat and electricity poorly, is brittle, waxy or gaseous, and cannot be hammered into sheets or drawn into wire. Non-metals gain electrons easily to form anions. About 20% of the known chemical elements are nonmetals.	**No metal**
Metalloid (mĕt'l-oid') Found in the area between the metals and the non-metals on the Periodic Table of Elements. They are sometimes called semi-metals and have characteristics that resemble both metals and non-metals.	**Metaloide o semimetal**
Alkalis ['ælkəlaɪ] First group of the periodic table of elements.	**Alcalinos**
Alkali earth ['ælkəlaɪ] /ɜ:rθ / Second group of the periodic table of elements.	**Alcalinotérreos**
Halogens ['hæləʊdʒən] The halogens are a series of nonmetal elements from Group 17 IUPAC Style (formerly: VII, VIIA) of the periodic table.	**Halógenos**
Noble gases /'nəʊbəl//gæsis/ Any of the elements of Group 18 (VIII, VIIIA), which includes helium, neon, argon, krypton, xenon, radon, and element 118. These elements are referred to as "inert" or "noble" because they do not easily form compounds with other elements.	**Gases nobles**
Transition elements /træn'zɪʃən//'eləmənts / A class of elements occurring in the periodic table in three series: from scandium to zinc; from yttrium to cadmium; and from lanthanum to mercury.	**Elementos de transición**
Inner transition elements /'ɪnər //træn'zɪʃən//'eləmənts / The elements in the two sections of the periodic table are usually separated from it and located below. These include fourteen elements in each case.	**Elementos de transición interna o Tierras raras**

Lanthanides (lăn'thə-nidis) A group of fourteen elements following lanthanum in the periodic table.	**Lantánidos**
Actinides (ăk'tə-nidis) A group of elements in the periodic table from actinium (atomic number 89) to lawrencium (atomic number 103).	**Actínidos**
Group /gru:p/ A vertical column in the Periodic Table.	**Grupo**
Period /'pɪriəd / The elements in a horizontal row of the periodic table .	**Periodo**
Decay elements /dɪ'keɪ//'eləmənts / Unstable elements.	**Elementos inestables**
Synthetic elements /sɪn'θetɪk/ /'eləmənts / Elements made artificially in a particles accelerator.	**Elementos sintéticos**
Chemical bond /'kemɪkəl//bɒnd/ Any of the several attractive forces that serve to bind atoms together to form molecules.	**Enlace químico**