Group:	2º ESO	Date:	
Content:	Unit 4 – Structure of matter 5: Introduction to the periodic system. 6: Chemical bonds		
Subject:	Physics and Chemistry		
Student:			

5. INTRODUCTION TO THE PERIODIC SYSTEM

The periodic table is a way to organize the elements. It was proposed by Dmitri Mendeleyev and Julius Lothar Meyer. Nowadays, there are 118 elements in the periodic table and we can classify them into 4 different types:

METALS	NON-METALS	NOBLE GASSES
- They are **shiny**. - They are **solid** at room temperature, except mercury, which is liquid. - They are **good conductors** of both heat and electricity. - They can be bent without breaking (they are **malleable** and **ductile**). They are **hard** and strong and they have a high density. - They tend to release electrons and become positive ions (**cations**). - Examples: Sodium (Na), Iron (Fe), Copper (Cu).	- They are **dull** (not shiny). - They are **solid, liquid or gases** at room temperature. - They are poor conductors of heat and electricity (they are **insulators**). - They are weak and brittle. - They tend to catch electrons and become negative ions (**anions**). - Examples: Fluorine (F), Sulfur (S), Nitrogen (N).	- They are practically **inert**. - They are all **gases**. - They are **insulators**. - All noble gases have the maximum number of electrons possible in their outer shell (2 for helium, 8 for all others) making them **stable**. - They are Helium (He), Neon (Ne), Argon (Ar), Krypton (Kr), Xenon (Xe) and Radon (Rn).
		

There is a fourth type: the METALLOIDS. They are elements with properties which are a mixture from metals and non-metals. Some metalloids are Boron (B), Silicon (Si), Germanium (Ge), Arsenic (As), Antimony (Sb), Tellurium (Te), Polonium (Po) and Astatine (At).

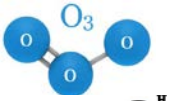
This **classification** based on the metallic and non-metallic elements is too simple. Nowadays we use two criteria to group the elements:

Increasing atomic number → Rows called PERIODS
Similar physic and chemical properties → Columns called GROUPS

6. CHEMICAL BONDS: MOLECULES AND CRYSTALS

Pure compound substances are made of different or equal types of atoms joined together to each other. The unions of these atoms are called BONDS. There are some exceptions to this rule: the noble gasses which they don´t make bounds.

Some examples are:
3 atoms of oxygen make an Ozone molecule→ Ozone gas (O_3) → Protective layer of the atmosphere



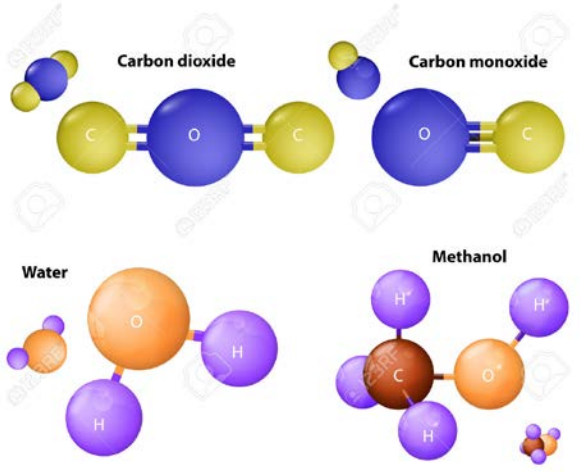
1 atom of oxygen and 2 atoms of hydrogen make a water molecule → Water (H_2O) → Indispensable for life

There are THREE different types of bounds based on the type of the element and the chemical form that they acquired:

BOND	ATOMS BONDED	ESTRUCTURE OBTAINED
COVALENT	Non-metal with Non-metal	Molecule or crystal structure
IONIC	Metal with Non-metal	Crystal structure
METALLIC	Metal with metal	Crystal structure

6.1 MOLECULES

Molecules are the minimum amount of a pure substance that it maintains all its properties. For example, the minimum amount of water is a molecule of it (H_2O). Molecules are formed when non-metallic **atoms** are bounded.



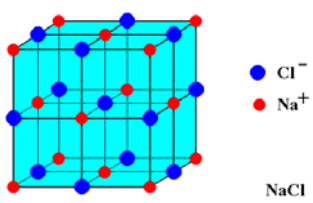
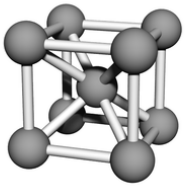
A **molecule** consists of two or more atoms of the same element, or different elements, that are chemically bound together. Note that the two nitrogen atoms which comprise a nitrogen molecule move as an unit.

There are small molecules made of a small number of atoms and others with a huge number of them. These last ones are called MACROMOLECULES. Examples of molecules: H_2SO_4, P_4, CH_4, CO_2, H_2O, CH_3OH, CO, N_2

6.1 CRYSTALS

Crystals are solids that form by a regular pattern of atoms connecting together. Ordered structures occur from the intrinsic nature of the constituent particles to form symmetric patterns that repeat along the principal directions of three-dimensional space in matter.

The smallest group of particles in the material that constitutes the repeating pattern is the **unit cell** of the structure. The unit cell completely defines the symmetry and structure of the entire crystal.

CRYSTALS		
IONIC	COVALENT	METALLIC
Metal with Non-metal - They dissolve easily in water and other polar solvents. - They use to be hard and solid substances with very high melting and boiling point. - Dissolved in water or molten, they can conduct electricity.	Non-metal with Non-metal - They are insoluble in all solvents. - They are very hard and have high melting and boiling points. - They do not conduct electricity.	Metal with metal - They are insoluble in all solvents. - They have variable melting and boiling points. - They conduct electricity.
 Salt (NaCl)	 Diamond (C)	 Iron (Fe)