Name _____ N°___

Surname _____

NATURAL SCIENCE

MATTER

MATTER

In this unit we are going to learn about:

1. Matter
2. Types of matter
   - Mixtures
   - Separation of mixtures
3. Changes in matter
4. Changes of state
5. Chemical changes
   - Types of chemical reactions: oxidation, combustion, and fermentation
   - Chemical reactions in everyday life

MY VOCABULARY

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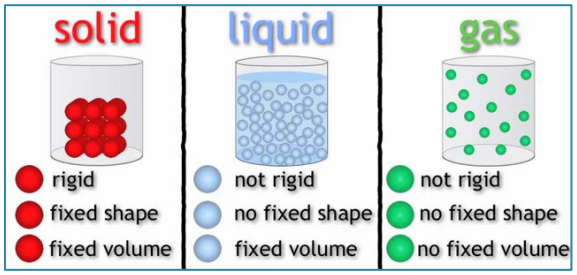
1. MATTER

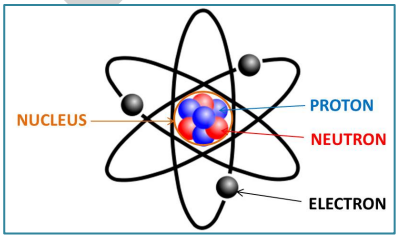
Everything around us, living and non-living is made up of **matter**: books, tables, the food we eat, the air we breathe and the water we drink.

All matter has **mass** and **volume**. Mass is a measure of how much matter there is. A book has a greater mass than a rubber. **Volume** is the amount of space the matter takes up. A pencil case has a larger volume than a pencil sharpener.



Matter exists in three states: **solid**, **liquid** and **gas**. Matter can't be created or destroyed; it just changes. It can undergo **physical** and **chemical** changes.

Atoms are the building blocks of matter. They are so tiny that we can only see them through a very powerful microscope. If you put four million atoms in a line, they would measure one millimetre.



- Matter with only one kind of atom is called an **element**.
- When two or more atoms join together, they form a **molecule**.
- When atoms of different elements join and react together, they form a **compound**.

An oxygen molecule has two oxygen atoms. Each water molecule has two hydrogen atoms and one oxygen atom.

Molecule is the general term used to describe any atoms that are combined by chemical bonds. Every combination of atoms is a molecule. A **compound** is a molecule made of atoms from different elements. All compounds are molecules, but not all molecules are compounds. Hydrogen gas (H_2) is a molecule, but not a compound because it is made of only one element. Water (H_2O) can be called a molecule or a compound because it is made of hydrogen (H) and oxygen (O) atoms.

WHAT ARE SOLUTIONS?

A solution is a mixture of one or more liquids with one or more other substances. In a solution, the substances are **dissolved** in the liquid.

When this happens, the components can't be distinguished from the mixture. For this reason, solutions are **homogeneous mixtures**.

The liquid components of a solution are called **solvents**. The other components are called **solutes**. Seawater is an example of a solution where the water is the solvent and the salt is the solute.

WHAT ARE ALLOYS?

Alloys are another type of **homogeneous mixture**. One or more of the substances in an alloy is always a **metal**.

- **Bronze** is an alloy of copper and tin. Bronze is a hard, resistant metal.
- **Steel** is an alloy or iron and carbon. It is hard, strong and light. It is very useful in construction and other industries.

Alloys have properties not present in the metals they contain, for example, steel is much stronger than iron.

Stainless steel is an alloy of steel and chromium. It is commonly used to make kitchen utensils.

Most substances we use are mixtures. For example, water is a pure substance, but we nearly always find it as a mixture, because other substances are dissolved in it, such as mineral salts and chlorine.

MAGNETIC SEPARATION

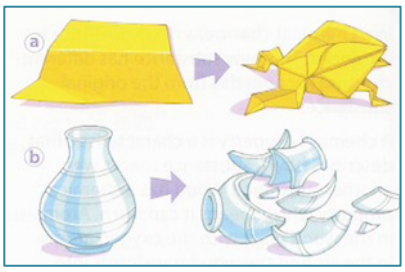
Magnets attract certain types of metals. We can use magnetic separation if we want to separate mixtures that consist of substances attracted by magnets and substances that are not. The magnet attracts the magnetic elements, leaving the other substances behind.

3. CHANGES IN MATTER

Everything around us is made of matter: our bodies, the air we breathe, the ground we walk on and the water we drink.

Matter can't be created or destroyed; it just changes. Matter experiences changes on daily bases. Think about an iron nail. If we throw it, it changes position. If we hit it with a hammer, it may bend. If we heat it, it will melt and if we leave it in a damp place, it will rust. These changes can be **physical** or **chemical**.

PHYSICAL CHANGES



A **physical change** means that the appearance of the matter changes, but its chemical properties are still the same. There can be changes in size (expansions), shape (deformations), colour or changes of state (melting, condensation…).

There are two types of physical changes:

- **Irreversible**, when matter cannot go back to its original state.
- **Reversible**, when matter can go back to its original state. Heat often causes this type of changes. For example, if a body gets hot, it **expands** and its volume gets bigger. If it gets cold, it **contracts** and its volume gets smaller.

CHEMICAL CHANGES

In a chemical change, a new substance is produced. This new substance has different chemical properties from the original substance. These changes are also known as **chemical reactions**. Chemical reactions, such as **oxidation** or **combustion**, change a substance into a new one with different properties when it comes into contact with **oxygen**. During **fermentation**, microorganisms (**yeast** and **bacteria**) decompose matter transforming it into new substances. The majority of chemical changes are **irreversible**.

MELTING POINT, BOILING POINT AND FREEZING POINT

Every pure substance changes from a solid to a liquid at a fixed temperature. We call this temperature the **melting point**. The melting point of water in 0 °C. Gold has a melting point of 1.064 °C and mercury -39 °C.

In addition, every substance changes from liquid to gas at a fixed temperature. This temperature is known as the **boiling point**. Water has a boiling point of 100 °C. Alcohol has a boiling point of 78 °C and mercury has a boiling point of 357 °C.

The **freezing point** is the temperature at which a liquid turns into a solid. The freezing point of water is 0 °C.

CHEMICAL CHANGES or CHEMICAL REACTIONS

Chemical changes happen when the original matter transforms into other substances. These changes involve **chemical reactions** in which atoms react and group together differently.

5.2. CHEMICAL REACTIONS IN EVERYDAY LIFE

Many important reactions happen around us in everyday life. For example:

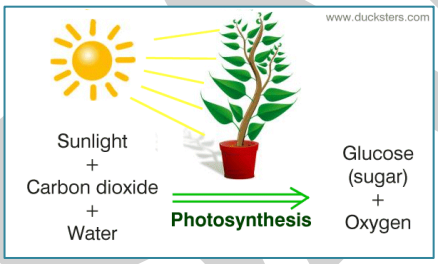
- Combustion happens in **vehicle engines** and in **thermal power plants** where electricity is produced.

- Many chemical reactions occur during **cooking**. They make food easier to digest and contribute to its taste.

- In the **food industry**, different types of fermentation help to produce many fermented foods, such as cheese or soy sauce.

- In the **chemical industry**, many products like **medicines** and **plastics** are the result of chemical reactions.

- Many chemical reactions take place **inside living things**, for example, the chemical reactions related to getting energy from nutrients in food. This process is known as **cellular respiration**.



- During **photosynthesis**, plants combine water and carbon dioxide using the energy from the Sun to produce carbohydrates.

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