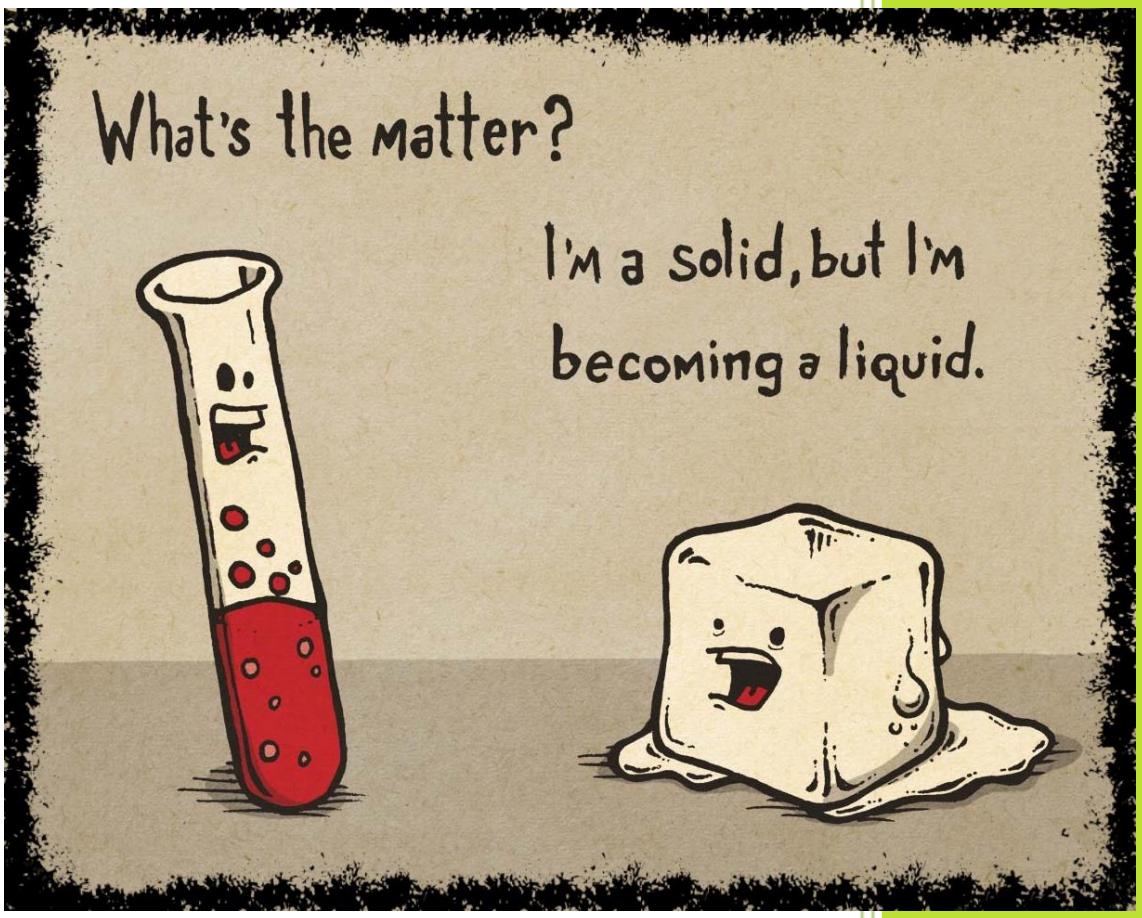
Unit:

MATTER



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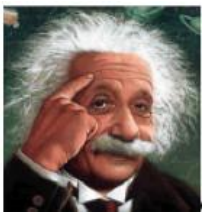
1. INTRODUCTION

Let's start this unit remembering what you learnt years ago about matter... for that, we are going to do an activity working in pairs.



✓ *Activity **A1**. Discuss whit your partner your thoughts and understanding "what is matter?". When you reach an agreement, try to write a short explanation.*

What is matter?

✓ *Activity **A2**. Draw a table with three columns. Label the columns for each of states of matter then classify the images.*

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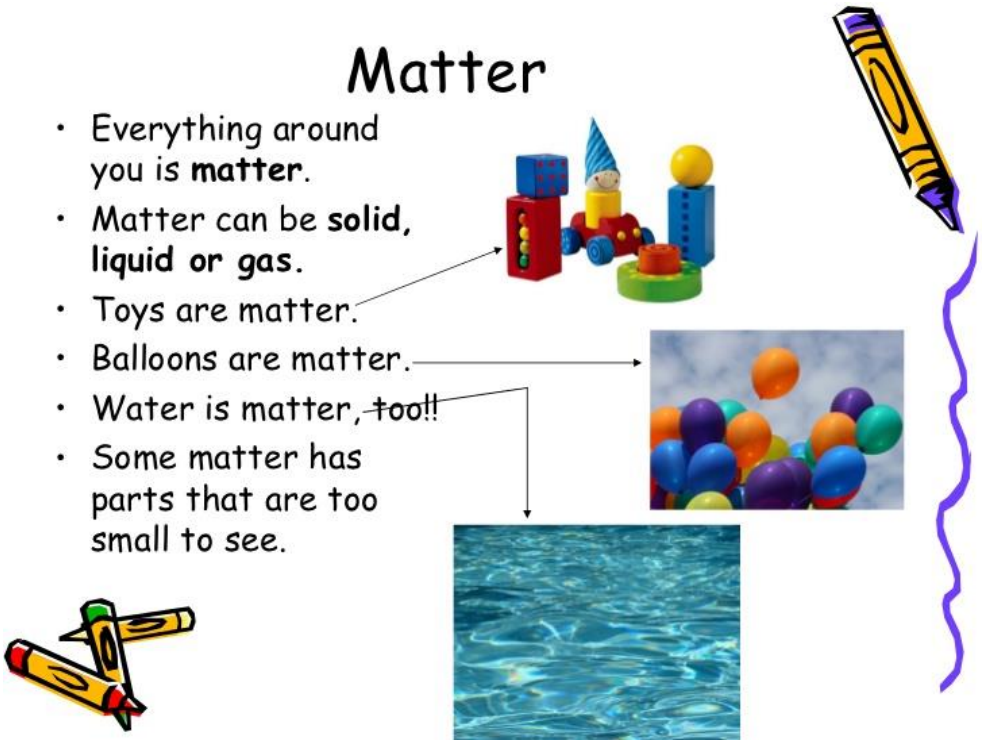
2. PROPERTIES OF MATTER



- ⇨ Matter is the material of which something is made or composed of.
- ⇨ All matter is made up of extremely tiny particles.
- ⇨ Matter ***occupies spaces*** and has ***mass***.
- ⇨ Matter includes all solids, liquids and gases.
- ⇨ Forms of matter have different characteristics.

- ⇨ The characteristics that are used to descibe matter are called ***properties***.
- ⇨ All matter has its own set of properties making the matter unique.

VIDEO WHAT'S MATTER?

https://www.youtube.com/watch?v=ELchwUIlWa8

(…when starting the investigation pause the video and discuss with the students what will happen?)

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✓ *Activity **A3**. Use the internet to try to find out the names for the extremely tiny particles which make up all matter.*

- ⇨ ***Name of this particles is…?***
- ⇨ ***DRAW IT!!***

✓ *Activity **A4**. Think of three different objects (a solid, a liquid and a gas) and list some properties for each one of them, such as state, weight, colour, smell, shape, taste, density, texture, solubility, rigid, bendable…)*

A solid…	*A liquid…*	*A gas…*
…	…	…

✓ *Activity **A5**. Work in pairs. You and your classmate are engenieers in a wheel factory. Make a list of advantages and disadvantages of using different materials (solid, liquid and gases) to make wheels. Finally, decide **which** material or materials you will use and **why**.*
(Useful vocabulary: wheel, tyre, rubber)

✓ *Activity **A6**. Some excavators use tyres without air inside.*
What do you think the main advantage of this is?
Why is this kind of tyre not used for cars?

Complete in your notebook

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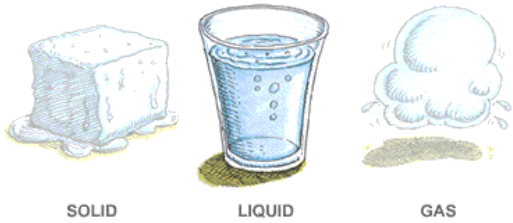
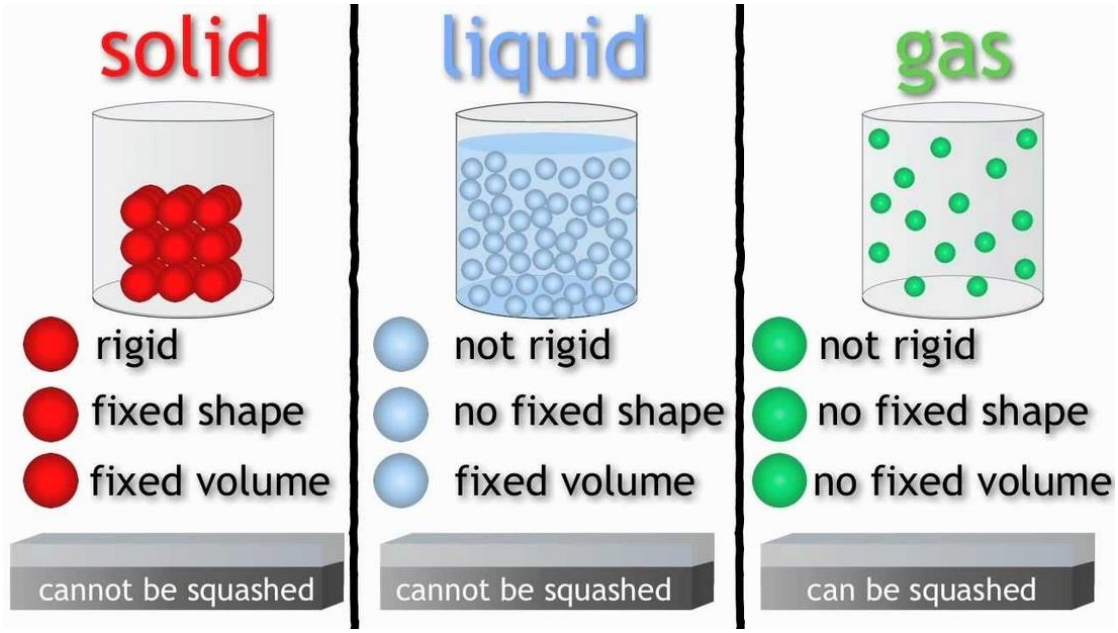


3. STATES OF MATTER

Basically, there are three states of matter. A material system can undergo a transformation depending on its temperatura. The simplest example is water, but you can imagine also a metal or a plastic.

It's very important consider that these changes are called ***"physic changes"*** because ***the composition of matter is the same.***

Let's see the different characteristics of the states of matter:



✓ *Activity **A7**. **Complete in your notebook.** Basically, there are three states of matter, however to tell the truth, are four states. Use the internet to try to find the name of the fourth state of matter and some examples of it.*

- ⇨ ***Name of fourth state:…***
- ⇨ ***Examples:…***

GAME

https://www.brainpop.com/games/mattersorter/

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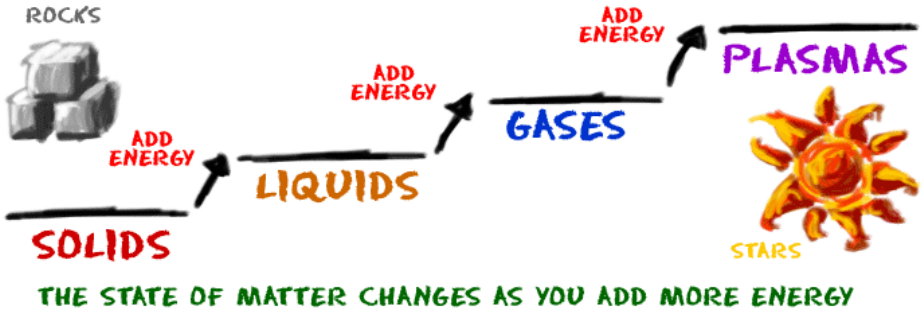
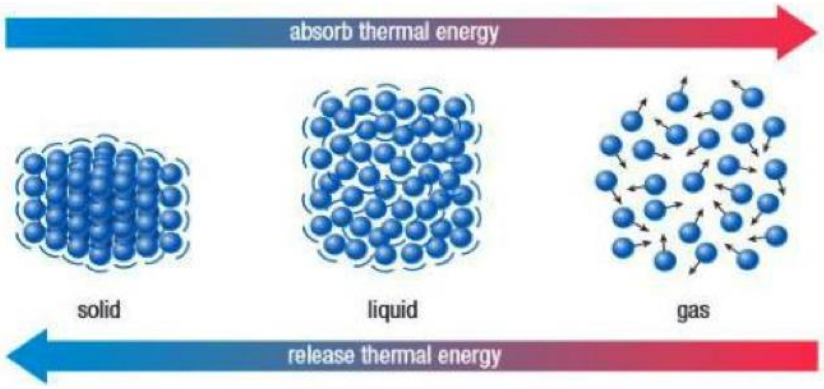
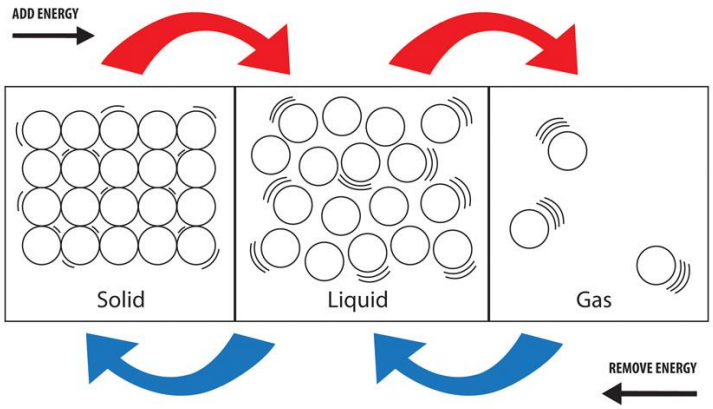
4. CHANGES OF STATE

Everybody knows that matter can change, but now it is time to discover why.

The three states of matter are: solid, liquid and gas. A change of state requires a change in the termal energy of a substance.







laboratory

https://phet.colorado.edu/en/simulation/legacy/states-of-matter-basics

http://www.educaplus.org/game/cambios-de-estado-del-agua

✓ *Activity **A8**. Use the internet to find what is the difference between, **vaporisation**, **evaporation** and **boiling**?*

✓ *Activity **A9**. Use the internet to try to find the names for the temperatures when a material system changes state.*

✓ *Activity **A10**. Work in pairs. Discuss and explain the meaning of the different processes about changes of matter.*

- ⇨ ***"melting: is the process when a solid is transformed in a liquid."***
- ⇨ ***"solidification:…"***
- ⇨ ***"evaporation:…"***
- ⇨ ***…***
- ⇨ ***…***
- ⇨ ***…***

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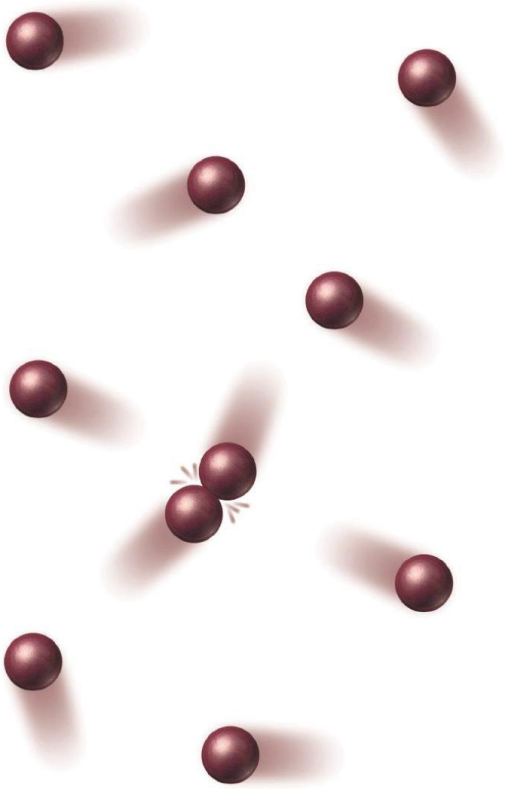
5. KINETIC MOLECULAR THEORY

The experimental observations about the behaviour of gases discussed so far can be explained with a simple theoretical model known as the kinetic molecular theory. This theory is based on the following postulates, or assumptions:



1. All collection of particles of a gaseous system are in constant motion.

2. There aren't attracctions or repulsions between particles (collisions are like billiard ball collisions).

3. There's a lot of space between the particles compared to the size of the particles themselves.

4. The speed that the particles move depend of the temperature, so its speed increases with increasing temperature.

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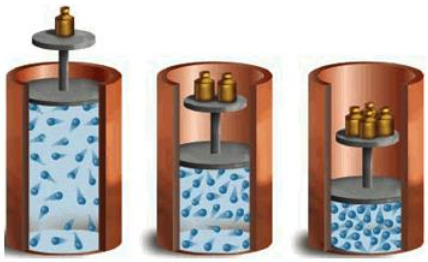
6. GAS LAWS

There are two laws for explaining what happen to a gas when the temperature (T), the presssure (P) or its volume (V) are changed.

1. BOYLE'S LAW

Boyle's law states that pressure of a gas in a closed container is inversely proportional to the volume of the container, when the temperature is constant. ***The volume is inversely proportional to pressure***: If the pressure increases, the volume decreases. If the pressure drops, the volume increases.



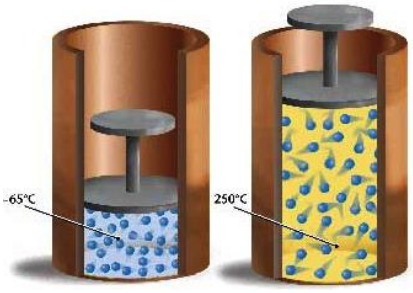
$$P \cdot V = k$$

2. CHARLES and GAY – LUSSAC LAW

Charles' Law and Gay Lussac's law, are the same law that indicates the relationship between the volume and temperature and pressure and temperature.

If we have a gas at **constant pressure**, when temperature increases, the volume increases too. But, when the temperature decreases, the volume decreases too. In other words, ***the volume and temperature of a gas are directly proportional***.

$$V = T \cdot k$$



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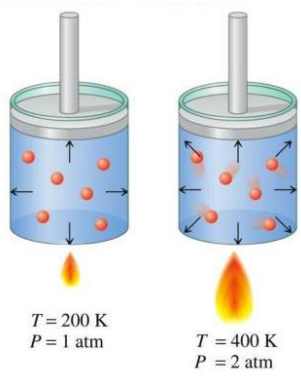
However, if we have a gas at **constant volume**, when temperature increases, the pressure increases too. But, when the temperature decreases, the pressure decreases too. In other words, ***the pressure and temperature of a gas are directly proportional.***



$$P = T \cdot k$$

Remember, if the temperature increases, particles move at higher speed.

✓ *Activity **A11**. In your notebook, or on graph paper, draw a graph with data obtained in the **virtual laboratory**. Compress the syringe plunger 35 ml, 30 ml, 25 ml ...and copy the data column. Finally do a graph P – V, in order to explain Boyle's law.*

http://www.educaplus.org/game/ley-de-boyle

✓ *Activity **A12**. Try to think of some examples to Charles and Gay Lussac examples. Discuss with your partner.*
(tyre, ball, pressure cooker, balloon…)

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7. PURE AND MIXTURED SUBSTANCES

There are many substances but we can classify them into two groups: pure substances and mixed substances.

Water, gold and oxygen are pure substances because they have one component. Mixed substances have two or more different substances. Sea water is a mixture because it contains water and salt. The air is also a mixture because it contains many gases. The salad in the picture is a mixture because it has many different fruits.

If we are able to easily distinguish its components it is called heterogeneous mixture. In other cases, such as seawater, we are not able to distinguish its components; in this case we have a homogeneous mixture or solution ("disolución" in Spanish). We speak of solutions to refer to dissolved solids in liquids, but also the air, a gas mixture is a solution; Homogeneus mixtures of solids such as metal alloys, e.g. coins, can be even called solutions. In all solutions we can differentiate the most abundant component or solvent and the solute, which is the minor component.

- ✓ *Activity **A13**. Are these mixtures homogeneous or heterogeneous?*

  a. Salad.

  b. Toothpaste.

  c. Strawerries and cream.

  d. Chocolate with nuts.

  e. Yogurt.

  f. Shoe cream.

  g. Sea water.

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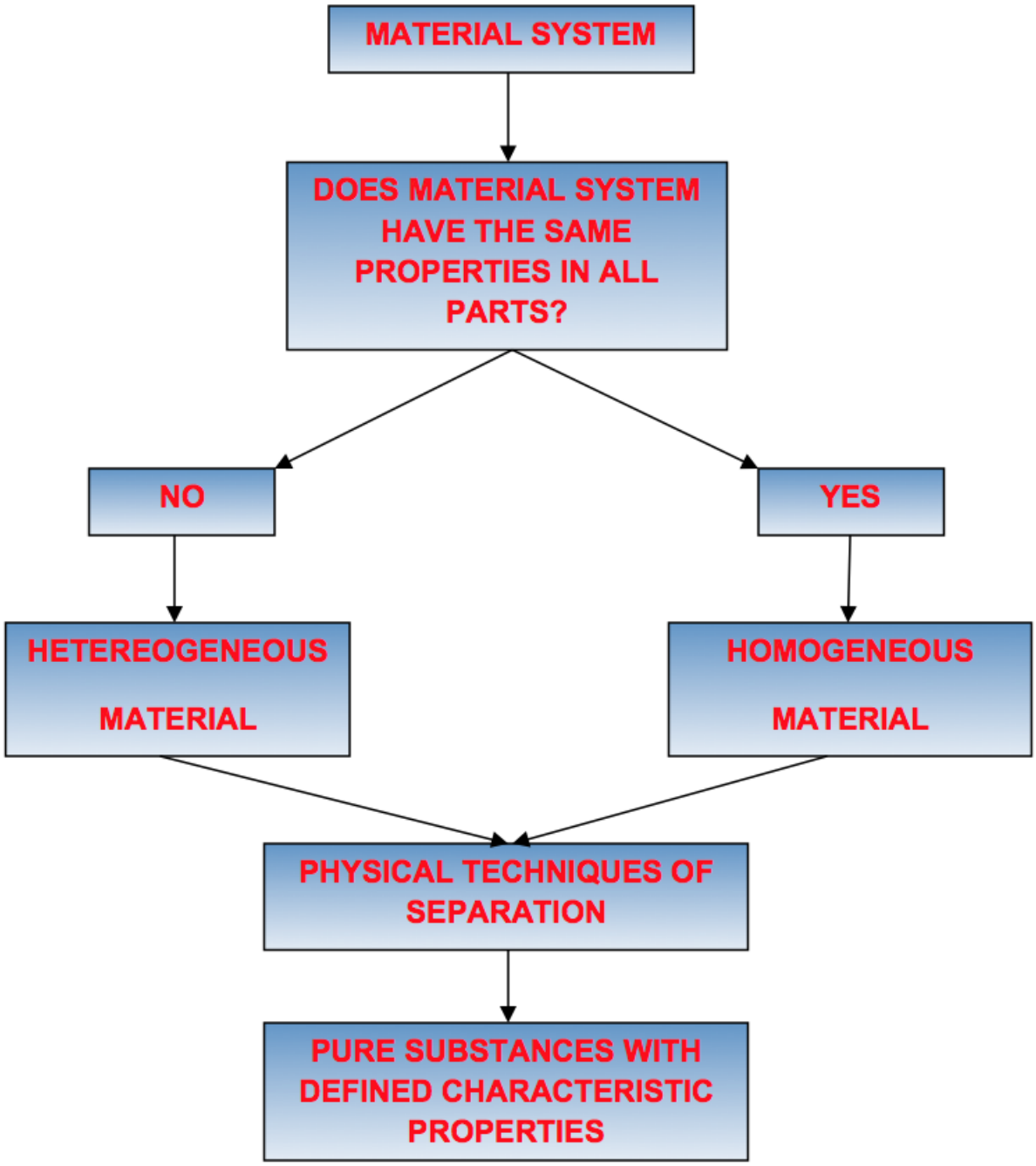
To summary, keep in mind the following mind map:



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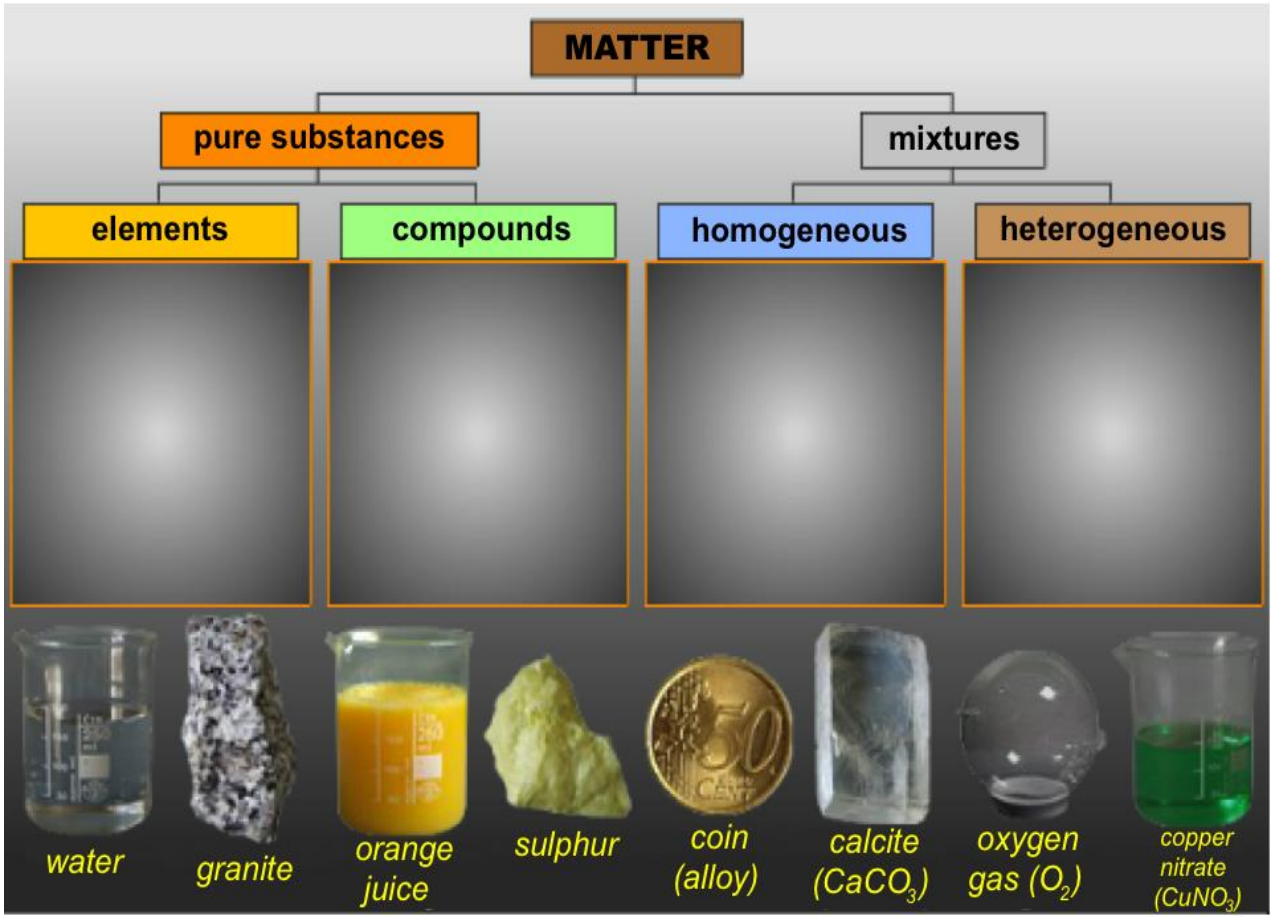
✓ *Activity **A14**. Copy the diagram bellow in yor note book and classify the material systems.*



✓ *Activity **A15**. **Complete in your notebook.** Among the substances**, water, alcohol, oil, sand, sugar** and **salt**, choose components to prepare mixtures of the following types:*

a. Homogeneous liquid:

b. Heterogeneous solids:

c. Dissolution of solid solute and the liquid solvent:

d. Heterogeneous liquid:

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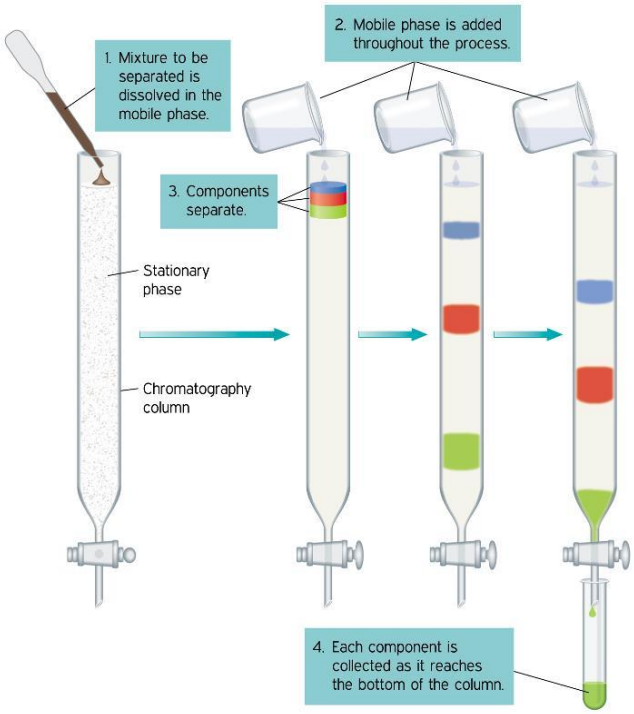
8. SEPARATION METHODS

Mixtures come in many forms and phases. Most of them can be separated, and the kind of separation method depends on the kind of mixture it is. Below are some common separation methods:

- ⇨ Chromatography
- ⇨ Filtration
- ⇨ Evaporation
- ⇨ Simple distillation
- ⇨ Fractional distillation
- ⇨ Magnetism
- ⇨ Separating funnel

⇨ Chromatography

This method is often used in the food industry. It is used to identify chemicals (coloring agents) in foods or inks. For example, if a scientist wants to know how many substances are in a particular blob of ink, paper chromatography can be used.



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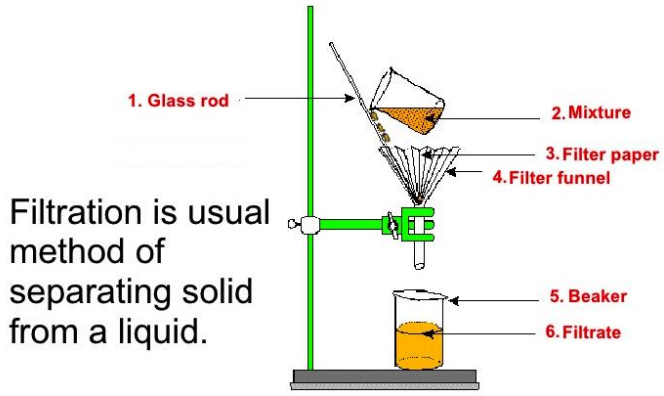
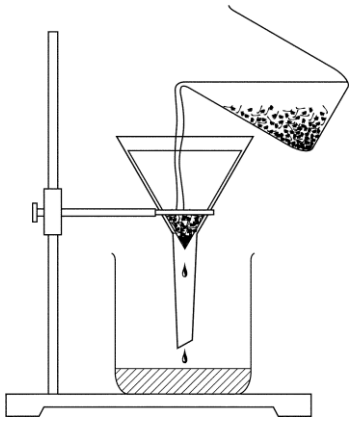
⇨ Filtration

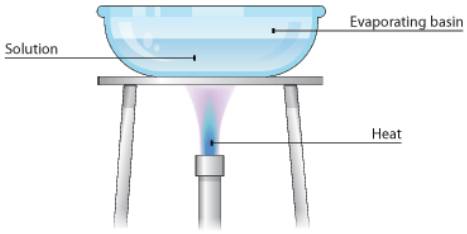
This is a more common method of separating an insoluble solid from a liquid. An example of such a mixture is sand and water. Filtration is used in water treatment plants, where water from rivers is filtered to remove solid particles.





⇨ Evaporation / Crystallization

Evaporation is great for separating a mixture (solution) of a soluble solid and a solvent. The process involves heating the solution until the solvent evaporates (turns into gas) leaving behind the solid residue.



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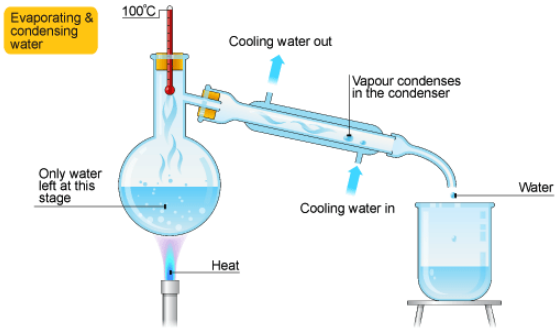
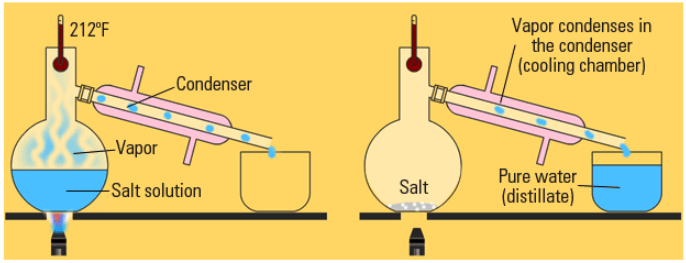
⇨ Simple distillation

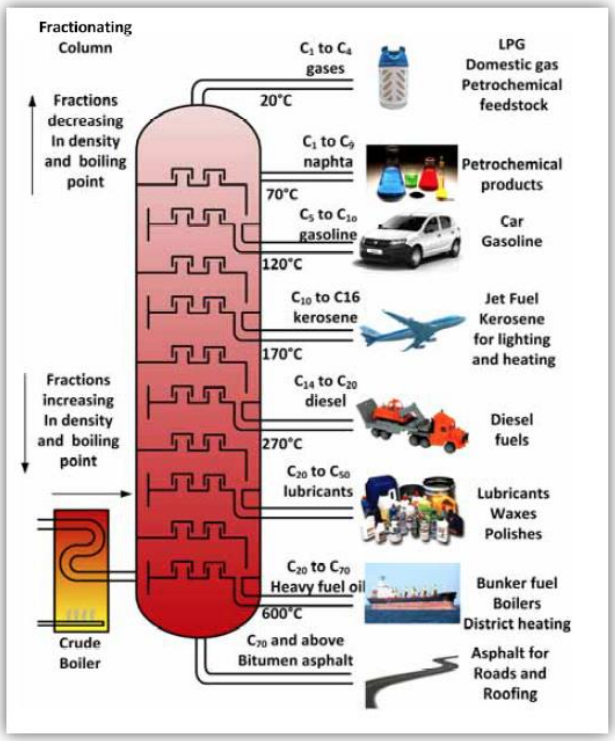
This method is best for separating a liquid from a solution. In a way, the concept is similar to evaporation, but in this case, the vapor is collected by condensation. For example, if you want to separate water from a salt solution, simple distillation would be great for this.





⇨ Fractional distillation

Similar to simple distillation, fractional distillation is best for separating a solution of two miscible liquids. (Miscible liquids are liquids that dissolve in each other). The Fractional method takes advantage of the different boiling points of the two liquids.



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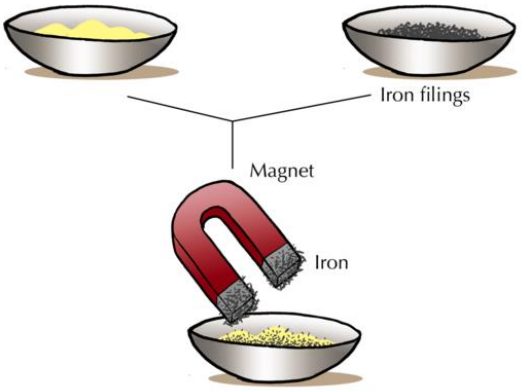
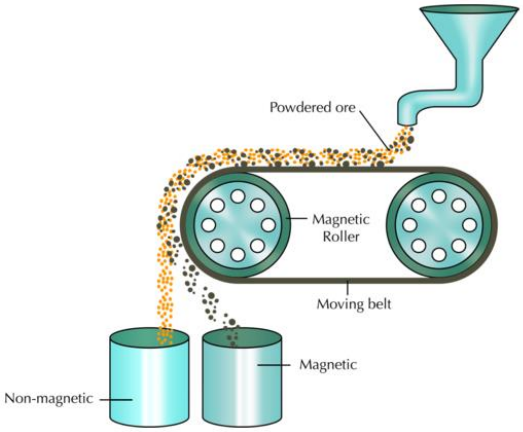
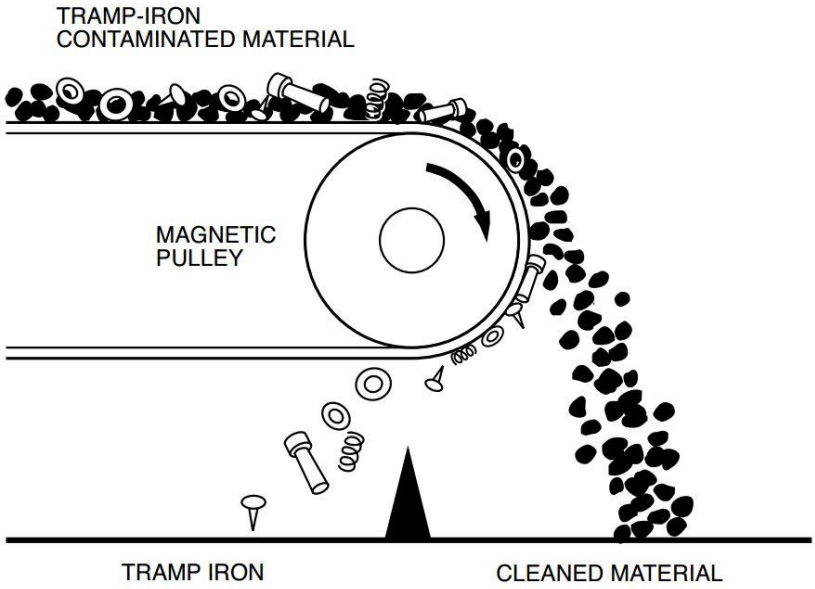
⇨ Magnetism

Magnetism is ideal for separating mixtures of two solids with one part having magnetic properties. Some metals like iron, nickel and cobalt have magnetic properties whilst gold, silver and aluminum do not. Magnetic elements are attracted to a magnet.







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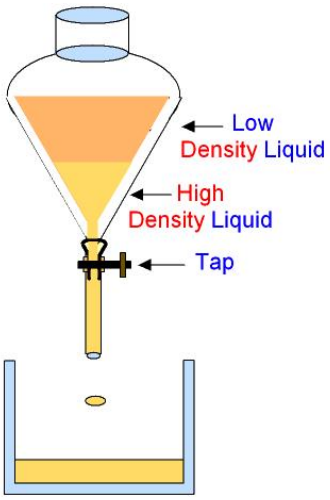
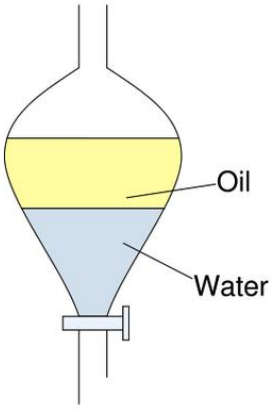
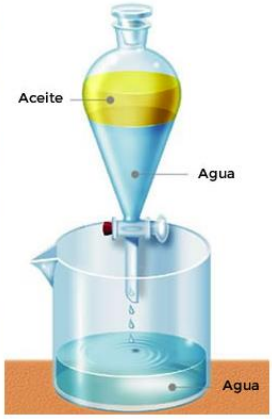
⇨ Separating funnel

In this technique, two liquids that do not dissolve very well in each other (immiscible liquids) can be separated by taking advantage of their unequal density. A mixture of oil and water, for example, can be separated by this technique.







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✓ *Activity **A16.** Use the internet to find out… What is a chromatograph used for in a laboratory? Write in your notebook a little summary.*

✓ *Activity **A17**. What is the main use of fractional distillation in the chemical industry? Draw a simple scheme of the process.*

✓ *Activity **A18**. **Complete in your notebook**. How can you separate them?*

a. Water from oil .

b. Sugar from iron particles.

c. Sand from water.

d. Sugar from sand.

e. Salt from water.

✓ *Activity **A19**. Terrific science: **CHROMATOGRAPHY ON PAPER***

Do a project in group with your classmates. Working in groups of 5 and following the instructions of above link, draw up a document in english answering the questions, after working in the separation of the components of different inks or vegetable pigments from leaves:

***a)** What's chromatography?*

***b)** Why components separation is produced?*

***c)** What's capilarity?*

***e)** Write a little essay with your own conclussions about this experience and including pictures of your chromatographies.*

The final PDF digital document must be deliver to e-mail teacher with a nice cover page, names of group components, answers to questions, photos and final conclussions.

VOCABULARY

In the table below write down the keywords learned from the unit with their meaning.

key word	meaning	key word	meaning

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