

3.1.- MATERIALS

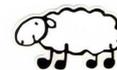
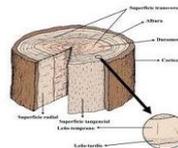
Choosing the correct material for any particular task is essential for a manufacturing activity.

RAW MATERIALS are substances extracted directly from nature.

Examples of raw materials: wood, stone, cotton, petroleum, marble, wool, minerals, sand,...

We can classify raw materials in 3 groups:

- ANIMAL raw materials: wool, silk, skin,...
- VEGETABLE raw materials : wood, cork, cotton,...
- MINERAL raw materials: sand, clay, marble, iron,...



PROCESSED MATERIALS are what we obtain if we transform the raw materials to have better properties. We use processed materials to elaborate a product.

For example, iron is a natural material because we obtain it from mines. If we add carbon atoms to the iron, we get steel and steel is stronger than iron with better properties.

Raw material	Processed material
Iron	Steel
Wood	Paper
Sand	Glass
Petrol	Plastic



The most used materials to elaborate technological products are:

- **WOOD:** obtained from the trees.
Examples of wood: fir, pine, chestnut
- **PLASTICS:** obtained from petrol, coal natural gas and animal protein.
Examples of plastics: PVC, polyurethane, foam
- **METALS:** obtained from minerals.
Examples of metals: steel, aluminium, copper, gold, silver
- **STONE MATERIALS:** obtained from the rocks.
Examples of stone materials: marble, plaster, granite
- **CERAMIC MATERIALS:** obtained from the clay.
Examples of ceramic materials: porcelain
- **TEXTILE MATERIALS:** obtained from vegetable raw materials and plastics.
Examples of textile materials: cotton, wool, silk, nylon, polyester.

TECHNOLOGICAL PRODUCTS are objects created by humans to satisfy their needs and make life better.

Raw material	Processed material	Product
Iron	Steel	Bridge structure, ships, tools,...
Wood	Paper	Book
Sand	Glass	Jug, window
Petroleum	Plastic	PVC pipe, plastic bag, mobile phone...

3.2.- PROPERTIES OF MATERIALS

Properties of a material are the group of characteristics that make the material behave in a particular way when it's exposed to external stimulus (light, heat, force,...)

They are split into 3 types:

- Physical properties
- Chemical properties
- Ecological properties

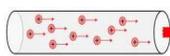
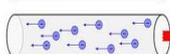
A) PHYSICAL PROPERTIES

- Electrical properties

- **Electrical conductivity:** is the ability of a material to let the electricity flow easily.

If we want the electricity to flow easily, we use conducting materials

If we don't want the electricity to flow, we use insulating materials

	CONDUCTING materials	INSULATING materials
	Metals	Plastics, Wood, Rubber

- Mechanical properties: describe the behaviour of the material when it's exposed to external forces

- **Elasticity:** is the ability of a material to change its shape when a force is applied to it and to recover its original shape when the force disappears. An excellent elastic material is rubber (you stretch it and recover quickly the shape)



- **Malleability:** is the ability of a material to be squeezed into a new shape of sheets when a compression force is applied to it. Metals and plastic are malleable.

- Application: aluminium foil to wrap sandwiches



- **Ductility:** is the ability of a material to be stretched into a new threads when a compression force is applied to it. Metals and plastic are ductile.

- Applications: ductile metals for jewellery(gold, silver) and copper for electricity cables.



- **Hardness:** is the resistance to changing shape when a force is applied. It can also be the capacity to scratch other materials.

The hardest material is the diamond and the less hard is talc.



- **Toughness:** is the resistance to breaking. Metals are tough, glass and porcelain are fragile.



- **Thermal properties**

- **Thermal conductivity:** is the ability of a material to let heat flow through a material. Heat flows easily through metals, so they are thermal conductors. However, heat doesn't flow easily through wood, ceramic or plastic, so they are thermal insulators.



- **Optical properties:** how materials behave when light touches them. We can classify materials into 3 types:

- **Transparent materials:** all light travels through them and you can see what's behind the materials. Example: glass in a window.

- **Translucent materials:** all light can travel through them but you cannot see what's behind them. Examples: frosted glass, textile materials.

- **Opaque materials:** No light travels through them. Examples: wood, metal, stone.

- **Acoustic properties:** how materials behave with sound.

Metals transmit sound very well

However, plastics and cork are acoustical insulators (polyurethane, Styrofoam)



- **Magnetic properties:** is the ability to attract other metals. Iron is the most magnetic metal.



B) CHEMICAL PROPERTIES

- **Oxidation:** The change that occurs to most metals when in contact with air (oxygen) or water. Metals tend to oxidise.



C) ECOLOGICAL PROPERTIES

- **Recyclable:** materials that can be reused. This property is becoming more important as the world gets more populated, there is more waste and there is less space for dump sites.



- **Toxic:** materials that are harmful to the environment because they can contaminate water and atmosphere.

- **Biodegradable:** materials that decompose naturally with time. Example: an apple takes about 20 days to decompose, a plastic 100 years and glass about 400 years.

ACTIVITIES:

- 1.- Which raw materials do these materials come from? Glass, steel, plastic, porcelain, planks, concrete.
- 2.- What manufactured goods or products can we make from the materials in exercise 1?
- 3.- Which materials are used to manufacture saucepans? Why the handles are made of plastic?
- 4.- Would you build? Why?
 - a) Shoes made of glass?
 - b) Umbrella made of paper?
 - c) Window made of stone?
- 5.- Why are cables manufactured with copper? Why are they covered with plastic?
- 6.- Tell which of the following materials are electrical conductors or insulators: plastic, aluminium, wood, iron, water, air, paper, steel, copper.
- 7.- What kind of materials would you use to soundproof a room?
- 8.- Which is the difference between recyclable and renewable? Write 3 recyclable materials and 3 renewable materials
- 9.- Can a hard material be brittle? Explain your answer with an example.
- 10.- Go to <http://www.bbc.co.uk/schools/ks2bitesize/science/materials.shtml> and click on the "Characteristics of materials" activity. Follow the instructions to do the activity. Go back to the first page and click on "Quiz". Complete the quiz. Good luck!

ANOTHER LINKS

<http://www.epa.gov/recyclecity/>

<http://www.planetpals.com/EDrecyclethings/recyclefacts.html>

UNIT 4 VOCABULARY

RAW MATERIAL: MATERIA PRIMA

COTTON: ALGODÓN

SILK: SEDA

WOOD: MADERA

WOOL: LANA

LINEN: LINO

METAL: METAL

IRON: HIERRO

STEEL: ACERO

ALUMINIUM: ALUMINIO

PETROL: PETRÓLEO

COAL: CARBÓN

STONE: PIEDRA

SLATE: PIZARRA

GRANITE: GRANITO

MARBLE: MÁRMOL

CORK: CORCHO

CLAY: ARCILLA

PLASTER: YESO

SAND: ARENA

POLYURETHANE: POLIURETANO

STYROFOAM: CORCHO BLANCO (CORCHOPÁN)

PROPERTIES: PROPIEDADES

CONDUCTOR: CONDUCTOR

INSULATOR: AISLANTE

ELASTICITY: ELASTICIDAD

MALEABILITY: MALEABILIDAD

DUCTILITY: DUCTILIDAD

HARDNESS: DUREZA

TOUGHNESS: TENACIDAD

BRITTLE: FRÁGIL

RECYCLABLE: RECICLABLE

RENEWABLE: RENOVABLE

BIODEGRADABLE: BIODEGRADABLE

TO MELT: DERRETIR

EXERCISES:

1.- Which materials are used to manufacture saucepans? Why the handles are made of plastic?

Metals because they transmit heat easily to the food. Handles are made of plastic because it is an insulator material.

2.- Would you build? Why?

- a) Shoes made of glass? No, because glass is fragile, therefore shoes would break easily.*
- b) Umbrella made of paper? No, because paper is not waterproof)*
- c) Window made of stone? No, because stone is not transparent*

3.-Why are cables manufactured with copper? Why are they covered with plastic?

Because copper is good conductor of electricity; electricity can flow through the wire. They are covered with plastic because plastic is good electrical insulator, which means that electricity will not escape from the wire.

4.-Tell which of the following materials are electrical conductors or insulators: plastic, aluminium, wood, iron, water, air, paper, steel, copper.

Conductors: aluminium, iron and copper

Insulators: plastic and wood

5.- What kind of materials would you use to soundproof a room?

- Plastic materials like polyurethane*
- Cork*

6.- Which is the difference between recyclable and renewable? Write 3 recyclable materials and 3 renewable materials

Recyclable refers to the materials that can be reusable. However, renewable refers to raw materials that can be found in nature in an unlimited way.

Recyclable materials: glass, paper, plastic, metals.

Renewable raw materials: wool, cotton, wood, water,...

9.- Can a hard material be brittle? Explain your answer with an example.

Yes it can. Glass is a hard material but it's fragile or brittle, it won't resist a hit.

10.- What happens if you put a piece of steel in contact with water?

It will corrode or get rusted.