

MATTER
AND
MATERIALS

MATTER AND MATERIALS

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MATTER

Main Objectives

1. To study and classify some materials and their properties.
2. To carry out activities to determine mass and volume of matter.
3. To study some materials which have contributed to progress in technology.
4. To be able to explain differences in terms of density and floatability.
5. To understand that changes occur when materials are mixed, and that the changes can be physical or chemical.

USEFUL WEBSITES: MATTER

http://www.harcourtschool.com/activity/states_of_matter/index.html Shows arrangement of particles in solids, liquids and gases.

<http://www.bbc.co.uk/education/dynamo/lab/dissolve.htm> Simple experiments to show properties of materials.

<http://www.teachingideas.co.uk/science/contents2materials.htm> Activities on classifying materials and on changing materials.

http://www.windows.ucar.edu/tour/link=/teacher_resources/floating_golf_edu.html Hands-on activities to describe and compare objects in terms of mass, volume, and density.

<http://www.nyu.edu/pages/mathmol/textbook/whatismatter.html> Basic information about matter, including solids, liquids, and gases, and their properties.

<http://www2.mcdaniel.edu/Graduate/TI/pages/LEWIS/matterweb.htm> Interactive page on solids, liquids, and gases, with lesson plans and activities for the children.

MATTER

colour

compress

density

elasticity

expand

flexibility

hardness

loose

mass

material

matter

measure

mixture

property

standard unit

stretch

take up

tight

volume

shape

Vocabulary Cards

<p>colour</p>	<p>n. the property possessed by an object of producing different sensations on the eye as a result of the way it reflects or emits light.</p> <p>"The rainbow has seven colours".</p>
<p>compress</p>	<p>v. 1. flatten by pressure; force into less space. 2. squeeze or press (two things) together.</p> <p>"Air will compress when the space available is reduced".</p>
<p>density</p>	<p>n. 1. the degree of compactness of a substance; mass per unit volume. 2. the quantity of people or things in a given area or space.</p> <p>"Salt water has a greater density than fresh water".</p>

<p>elasticity</p>	<p>n. the property of returning to an initial form or state following stretching.</p> <p><i>"A balloon is elastic"</i></p>
<p>expand</p>	<p>v. make or become larger or more extensive.</p> <p>" The air will expand when the space available increases".</p>
<p>flexibility</p>	<p>n. the property of bending easily without breaking.</p> <p>" Your clothes and paper are flexible materials".</p>

<p>hardness</p>	<p>n. the property of being solid, firm, and rigid; not easily broken, bent, or pierced.</p> <p>" A diamond is much harder than a rock".</p>
<p>loose</p>	<p>adj. not firmly or tightly fixed in place; not fitting tightly or closely.</p> <p>" If your belt is loose, your trousers will fall down".</p>
<p>mass</p>	<p>n. the quantity of matter which a body contains.</p> <p>" The greater the mass of an object, the more it weighs on a scale".</p>

<p>material</p>	<p>n. the substance or substances out of which a thing is or can be made.</p> <p>"Wood is a natural material, but paper is an artificial one".</p>
<p>matter</p>	<p>n. something that has mass and takes up space, and exists as a solid, liquid, or gas.</p> <p>"A person, a book, and lemonade are made of matter".</p>
<p>measure</p>	<p>v. determine the size, amount, or degree of (something) by comparison with a standard unit.</p> <p>"We measure the volume of a liquid in liters".</p>

<p>mixture</p>	<p>n. 1 a substance made by mixing other substances together. 2 (a mixture of) a combination of different things in which the components are individually distinct.</p> <p>"Lemonade is a mixture of lemon juice, sugar, and water".</p>
<p>property</p>	<p>n. An essential or distinctive characteristic or quality of a thing: <i>the chemical and physical properties of an element.</i></p> <p>"Elasticity is a property of rubber".</p>
<p>shape</p>	<p>n. the external form or appearance of someone or something.</p> <p>"Liquids take the shape of their container".</p>

<p>standard unit</p>	<p>n. an agreed system for measuring: grams, meters, or liters are standard units.</p> <p>"The standard unit to measure the weight of an object is the gram".</p>
<p>stretch</p>	<p>v. (of something soft or elastic) be made or be able to be made longer or wider without tearing or breaking.</p> <p>"If you stretch an elastic band it won't break".</p>
<p>take up</p>	<p>v. occupy time, space, or attention.</p> <p>"A dining table takes up a lot of space in your living room".</p>

<p>tight</p>	<p>adj. fixed, closed, or fastened firmly.</p> <p>"If your trousers are very tight you might get a tummy ache".</p>
<p>volume</p>	<p>n. the amount of space occupied by a substance or object or enclosed within a container.</p> <p>"We measure volume in cubic meters".</p>

MATTER AND MATERIALS

Glossary

colour: n. the property possessed by an object of producing different sensations on the eye as a result of the way it reflects or emits light.

compress: v. 1. flatten by pressure; force into less space. 2. squeeze or press (two things) together.

density: n. 1. the degree of compactness of a substance; mass per unit volume. 2. the quantity of people or things in a given area or space.

elasticity: n. the property of returning to an initial form or state following stretching.

expand: v. make or become larger or more extensive.

flexibility: n. the property of bending easily without breaking.

hardness: n. the property of being solid, firm, and rigid; not easily broken, bent, or pierced.

loose: adj. not firmly or tightly fixed in place; not fitting tightly or closely.

mass: n. the quantity of matter which a body contains.

material: n. the substance or substances out of which a thing is or can be made.

matter: n. something that has mass and takes up space, and exists as a solid, liquid, or gas.

measure: v. determine the size, amount, or degree of (something) by comparison with a standard unit.

mixture: n. 1 a substance made by mixing other substances together. 2 (a mixture of) a combination of different things in which the components are individually distinct.

property: n. An essential or distinctive characteristic or quality of a thing: *the chemical and physical properties of an element.*

shape: n. the external form or appearance of someone or something.

standard unit: n. An agreed system for measuring: grams, meters, or liters are standard units.

stretch: v. **1** (of something soft or elastic) be made or be able to be made longer or wider without tearing or breaking. **2** pull (something) tightly from one point to another.

take up (took up, taken up): v. occupy time, space, or attention.

tight: adj. fixed, closed, or fastened firmly.

volume: n. the amount of space occupied by a substance or object or enclosed within a container.

KEY
QUESTION
CARDS

Is paper a
natural or an
artificial
material?

Which has
more density,
salt water or
fresh water?

Which property
makes a material
difficult to scratch,
cut or pierce?

What is an
insulator?

What is a
conductor?

What are the
three states
of matter?

What is
magnetism?

Are drawing
pins magnetic?

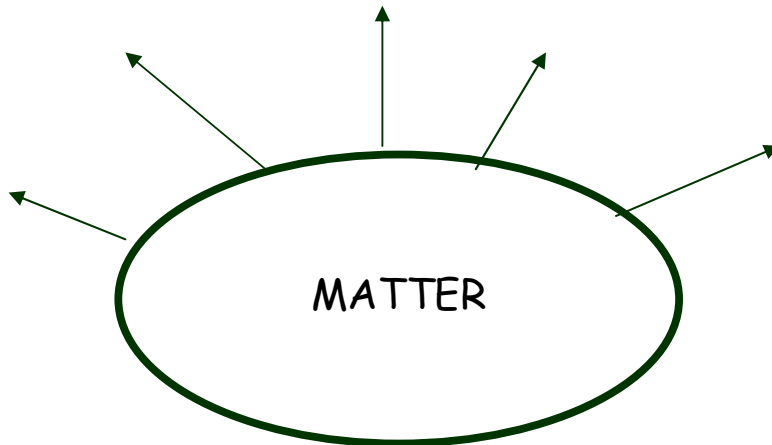
What are two
properties of
liquids?

What are two
properties of
solids?

What are two
properties of
gases?

PRIOR LEARNING

Write 5 facts you know about matter.
Add more arrows if you know more.



**MATTER: HANDS-ON
ACTIVITIES**

- Objectives
- Is the bottle really empty?
- Clean the cent.
- Floating egg.
- Experiment Record Sheet
- Survey Sheet
- Facts sheet: Matter; put it to the test

Hands on Activity
Matter: Put it to the Test!
OBJECTIVES

The purpose of this activity is to prove right the facts sheet Matter: Put it to the Test, by carrying out the three experiments. Every experiment should begin with the reading of this fact sheet, and it should end with checking if the experiment proves some of the facts. The survey sheet and record sheet can also be used with either activity.

- **Objectives: 1. To use different procedures to determine mass and volume of matter. 2. To observe physical and chemical changes by mixing matter. 3. To understand that different types of matter have different densities, and that this affects to whether they sink or float.**

1. IS THE BOTTLE REALLY EMPTY?

- **Before you start:** With this activity children will prove that air takes up space. They will try to pour water into an 'empty' bottle which has a funnel sealed to it with plasticine. The water will stay in the funnel because the air cannot leave the bottle.

You will need:

- A small funnel per group
- A small plastic bottle per group
- A big chunk of play dough per group
- A cup of water per group



Procedures:

1. Give each group an empty bottle, the funnel and the plasticine. Ask the children to seal the funnel to the bottle with plenty of plasticine. Walk around and monitor that the funnel is firmly sealed, or the experiment won't work!

2. Write this question on the board:

What will happen when we pour water into the bottle?

- A) The water will flow into the bottle
- B) The water will stay in the funnel
- C) There will be bubbles
- D) The plasticine will dissolve

3. Have the children survey their classmates' predictions. Use the survey sheet to make a bar graph.

4. Give each group the cups with water and have them pour the water in the funnel.

5. Ask them to write their observations on their experiment record sheet.

6. Explain that the water didn't go through because the bottle is full of air, and air occupies space inside the bottle. Ask children to write a conclusion (why the water stayed in the funnel) on their record sheet.

2. CLEAN THE CENT.

- **Before you start:** With this activity children will observe a chemical change by mixing two substances: vinegar and salt. The new solution (Hydrochloric acid) will clean the dirt on a copper coin, like a 5-cent coin.

You will need:

- A very dirty 5 cents coin per group.
- A plastic cup per group.
- White vinegar.
- Salt.
- A spoon to stir
- Paper towels



Procedures:

1. Write this question on the board:

What will happen to a dirty 5-cent coin when we dip it in a salt and vinegar mixture?

- A) The coin will dissolve
- B) The coin will remain the same
- C) The coin will get clean as new
- D) The coin will become soft

2. Give each group the materials and have them mix the salt and vinegar. Stir well with the spoon. Ask the children to dip half the coin in the solution, and place it on the paper towel. Write observations on record sheet.

3. Ask the children to write their observations on their record sheets. Their conclusion should include the term chemical change.

3. FLOATING EGG.

- **Before you start:** This activity will demonstrate that dissolving a substance in water (salt) will change the density of the mixture, and how this affects floatability. Children will test sinking a boiled egg in two jugs of water, one with fresh water and the other with salt water. The egg in the salt-water solution should float. (As an extension, the children can find out the volume of the egg by measuring how much the water rises and subtracting that amount to the initial mark. They can also find out the mass of the water by weighing the container with water, then the empty container, and then subtracting).

You will need:

- Two measuring jugs with water per group
- Salt
- A boiled egg per group
- A spoon
- Paper towels
- Post-it pad



Procedures:

1. Write this question on the board:

What will happen when we introduce the egg in the two jugs?

- A) The egg will sink in both jugs
- B) The egg will float in both jugs
- C) Egg will sink in jug A but will float in jug B
- D) Egg will float in jug A but will sink in jug B

2. Give children the two jugs and post-it, and ask them to label them A and B. Fill them with the same amount of water.
3. Ask children to add salt to jug B, and stir, until no more salt dissolves.
4. Give each group a boiled egg, and ask them to put it in jug A. Write observations on notebook.
5. Ask them to try the same in jug B. Write down observations.
6. Explain to the class why the egg floated in jug B but it sank in jug A. Children write their conclusions (why) in their notebooks.

(Extention: Can you find out the volume of the egg submerged in fresh water? Can you find out the mass of the water in the container?)

EXPERIMENT RECORD SHEET

Question: (What we want to test)

Procedures: (How we conducted the test)

Conclusion: (why)

Make a survey: ask your classmates what their prediction is.
Show your results on a bar graph.

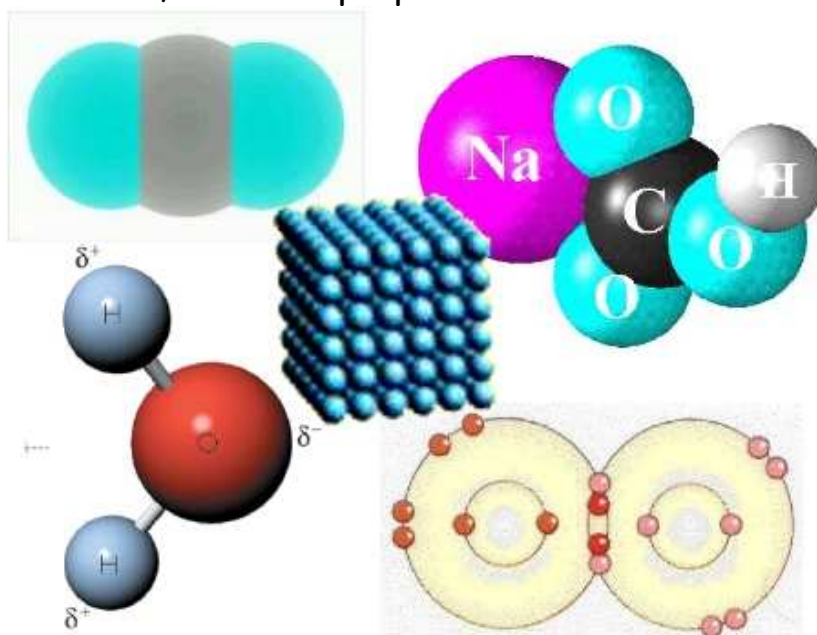
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	A	B	C	D

MATTER

Put it to the Test

- **Matter** is everything around you that **takes up space (volume) and has a mass (weight)**.
- **Matter also has density**. Density is how many particles of matter are contained in a certain space or volume.
- Matter can be found in **three states: solid, liquid, or gas**. Therefore, a pencil is matter, water is matter, and the air is matter too.
- **Solids have a constant shape and volume**. This means that a solid will not change its shape unless you break it, and it takes up the same space, regardless of where you place it. The particles that make a solid are arranged close together in a tight structure, which allows very little flow among them.
- **Liquids have a constant volume, but a variable shape**. This means that a liquid will occupy the same space, but it will change shape, depending on the container where it is found. The particles of a liquid are arranged a bit looser and unorganized, and allow a greater flow among them.
- **Gasses have both a variable shape and volume**. This means that a gas will change to the shape of the container where it is found, and it will change volume too, because it can expand or compress, depending on the space available. The particles that form a gas are arranged in an even more unorganized structure, and flowing even more so than a liquid's.

- **Matter can be mixed.** When we mix different materials, we can obtain a **reversible mixture** or a **non-reversible mixture**. For example, the mixture of salt and water can be reversed; when water evaporates the salt will be left behind. The mix of flour, water, and oil, cannot be reversed. When water evaporates, the mixture will dry, but we cannot separate flour and oil out of it.
- **Matter can undergo physical and chemical changes.** A physical change is for example when matter evaporates and changes from liquid to gas. It is still water. A chemical change is for example, when we mix vinegar and salt. A new substance is then created, with new properties.



PLASTIC: Read and Understand.



In the late 1800 an American inventor called Wesley Hyatt created the first plastic material. Since then, plastic has been used in many different ways and for many different purposes.

Plastic is a very strong material, but at the same time is light. It is very resistant to weathering, and it is very versatile. This means that it can adapt to many different purposes; it is used in many parts of machines, to make furniture, toys, carrier bags, bag packs, and many other things.

But plastic is made from petrol. As you probably know already, petrol is a non-renewable natural resource, which is used for many different purposes, the main one being as fuel for vehicles. Being non-renewable means that one day there will be no more petrol left.

In Spain, we use around 15 million plastic bottles every day. It seems wise to use these bottles over and over again, so we don't have to use up more petrol.

This is why recycling plastic has become part of our daily routine over the past few decades.

Another reason why plastic is recycled is of course the environment. Plastic that is not recycled ends up in a landfill, where it lies with the rest of the rubbish. Landfills are huge hills of waste where rubbish of all kinds is kept. This rubbish is burned, or buried, and is highly polluting. Some of this rubbish will decompose, but plastic won't.

So now let's take a close look at how the recycling process works.

The cycle begins when you buy a product in a plastic bottle, such as washing up liquid, shampoo, a drink, or laundry detergent.

When the bottle is empty, you wash it thoroughly, and take it to the recycling yellow bin. It is very important that the bottle is free from any remains of the product it previously contained otherwise it won't be suitable for recycling.

The yellow bin is then emptied into a truck and all the bottles are taken to a recycling factory.

Once in the factory, all the bottles are sorted into different types of plastic, to be recycled separately. Plastic bottles are made from three main types of plastic. Look for numbers 1, 2, or 3 inside a triangle on the outside of your plastic bottles.

Then the sorted plastic is washed again and shredded into small flakes. These flakes are melted down at high temperature in a special furnace, and new plastic items are created. The new plastic items will then reach the supermarket, and the cycle begins again.

ANSWER THESE QUESTIONS

1. What is plastic made of? _____

2. What is a non-renewable resource? _____

3. What is a landfill? _____

4. How are the plastic bottles sorted in the Recycling factory? _____

5. List some plastic objects that we use in our daily lives. _____

6. What happens after the bottles have been sorted in the factory? _____

7. What do you think could happen if we didn't recycle any plastic bottles? _____

8. Aproximately how many plastic bottles are used in Spain every day? _____

9. What are some properties of plastic? _____

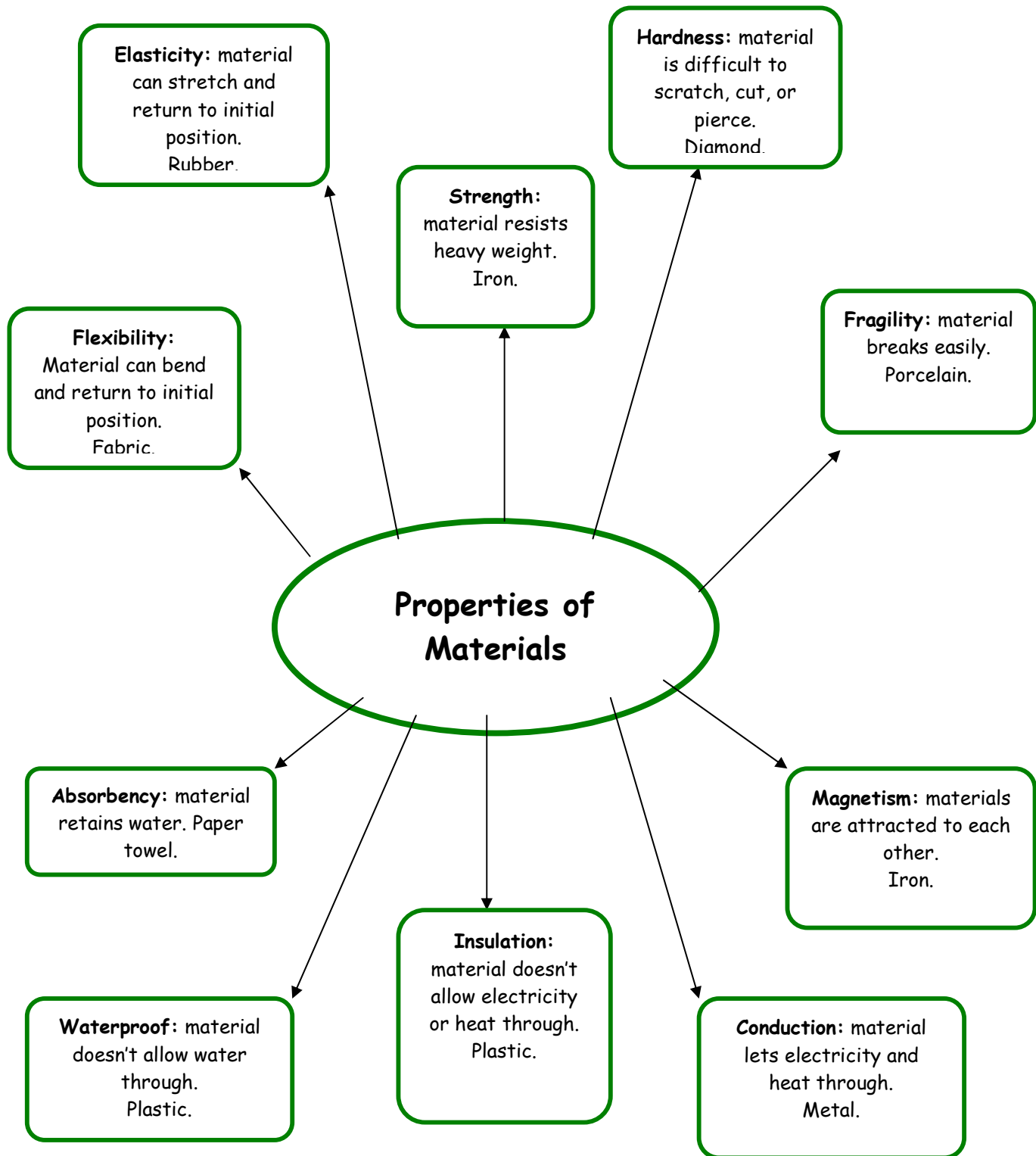
10. What do you think a furnace is? _____

GROUPING AND CLASSIFYING MATERIALS Fact Sheet



- **Materials are all around us;** they can be natural, like wood, or artificial, like paper. We use them to make all sorts of objects and machines.
- **Natural materials** can be found in nature, and they can be of animal, mineral, or vegetal origin. Wool, cotton, and slate are some examples.
- **Artificial materials** are natural materials that have been transformed by people. Plastic, concrete, and steel are some examples.
- The **main properties** of materials are: flexibility -fabric-, elasticity -hair band-, strength -iron-, hardness -diamond-, fragility -porcelain-, absorbency -paper towel-, waterproof -plastic-, and conductivity. Materials can also be magnetic.
- **A conductor** is a material that allows electricity and heat to pass through it easily. Metal and water are good conductors.
- **An insulator** is a material that does not allow electricity or heat to pass through it easily. Wood and plastic are good insulators.
- **We make objects out of different materials, depending on their properties.** For example, we make wellington boots out of rubber and plastic because these materials are flexible and waterproof. We make the handle of a frying pan out of wood because this material is a good insulator.

GROUPING AND CLASSIFYING MATERIALS.



GROUPING AND CLASSIFYING MATERIALS

Complete the sentences using the words in the box.

artificial material conduction insulation waterproof elasticity
strength hardness fragility magnetism

_____ is the property that allows a material to support weight without breaking or bending.

_____ is a material that has been manufactured by people.

_____ means that an object is easy to break.

_____ is the property by which an object is difficult to cut, scratch, or pierce.

_____ is the property that allows heat and electricity to pass through it.

_____ is the property that prevents water from passing through a material.

_____ is the property that allows a material to stretch and change its shape and later recuperate its original shape.

_____ is the property that prevents electricity and heat from passing through it.

_____ is a property that makes some materials be attracted by other materials.