

Sabrina Sopranzi

FLASH on English

for MECHANICS, ELECTRONICS
& TECHNICAL ASSISTANCE



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1

Materials

A mechanical engineer uses different materials to build **machinery** or **tools**. A specific knowledge of materials is required, concerning qualities, properties, costs and general characteristics.

1 What are these objects made of? Match the words in the box with the pictures, then read the text.

steel gold wood plastic
glass ceramic



1 _____



2 _____



3 _____



4 _____



5 _____



6 _____

When a machine or a tool is made, the most suitable material must be chosen by considering its properties, which can be classified as mechanical, thermal, electrical and chemical. The main types of materials used in mechanical engineering are metals, polymer materials, ceramics and composite materials. The most commonly used materials are metals, which can be divided into ferrous and non-ferrous. They can be used in their pure form or mixed with other elements. In this second case we have an **alloy** and it is used to **improve** some properties of the metals. The most commonly used ferrous metals are iron and alloys which use iron. Because iron is soft and pasty it is not suitable to be used as a structural material, so a small amount of **carbon** is added to it to make **steel** alloy.

Non-ferrous metals contain little or no iron. The most common non-ferrous metals used in mechanics are **copper**, **zinc**, **tin** and **aluminium**. Some common non-ferrous alloys are **brass** (formed by mixing copper and zinc), **bronze** (formed by mixing copper and tin) and other aluminium alloys which are used in the aircraft industry. Other examples of materials used in mechanical engineering are **plastic** and **rubber**.

PVC or polyvinyl chloride is a type of plastic and is used to **insulate** **wires** and **cables**. Rubber is a polymer and its best property is elasticity, as it returns to its original size and shape after deformation. Ceramic materials are good insulators: hard, resistant and strong, but **brittle**. Composite materials are made up of two or more materials combined to improve their mechanical properties. **Concrete** is reinforced with steel and is used in building engineering.

2 Read the text again and match the words with their definitions.

- 1 alloy
- 2 steel
- 3 PVC
- 4 concrete
- 5 brass
- 6 ferrous materials
- 7 ceramic
- 8 iron

- a ☐ a type of plastic used for insulation
- b ☐ a combination of different metals
- c ☐ an alloy formed by mixing iron and carbon
- d ☐ an alloy formed by mixing copper and zinc
- e ☐ metals containing iron
- f ☐ a composite material used to build houses
- g ☐ a metal not suitable as structural material
- h ☐ a good insulator but brittle

3 Read the text again and answer the questions.

- 1 What is the basic classification of metals?
- 2 What are the characteristics of iron?
- 3 Why are alloys created?
- 4 Which materials are good insulators?
- 5 Is steel an alloy? Which metal does it contain?

4 Listen and complete the definitions with the words in the box.

cooking coins alloy air copper wires steel
carbon gold ferrum expensive ductile

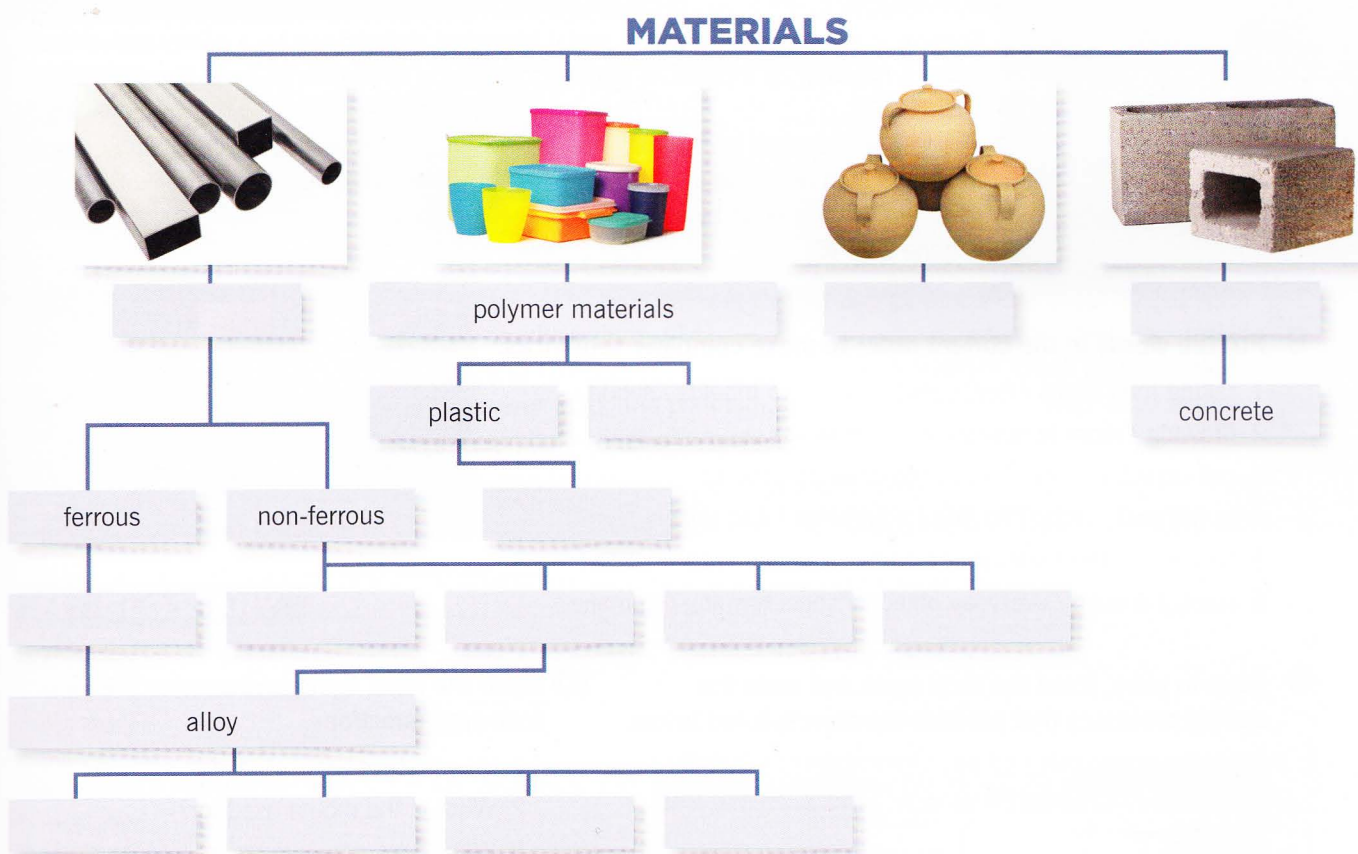
Iron: Its Latin name is (1) ferrum. It is magnetic and has a silvery colour. In prehistoric times it was used to make ornaments and weapons. If exposed to the (2) _____, it **oxidises**.

(3) _____: It is one of the most widely used metals by humans. In prehistoric times it was used to make cooking utensils, (4) _____ and ornamental objects. It is used in (5) _____ and cables.

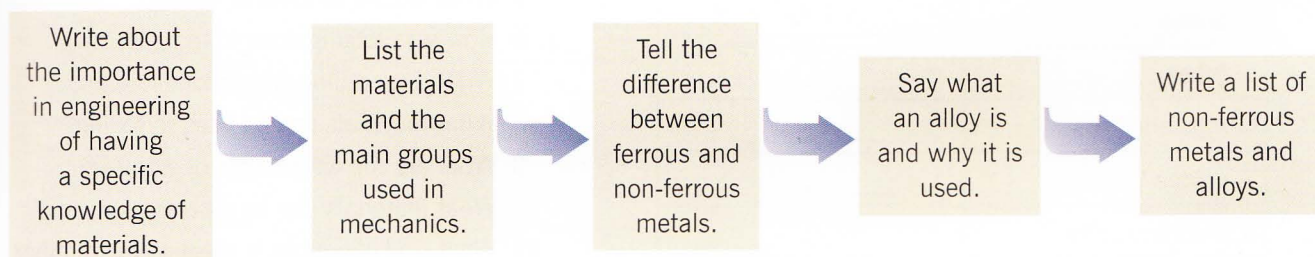
(6) _____: It is the most (7) _____ metal and is used to create precious jewellery. It is the most (8) _____ metal.

(9) _____: It is an (10) _____ formed from iron and (11) _____. It can contain between 2.1% and 4% carbon. It is also used for (12) _____ utensils and pans.

5 Complete the following diagram.



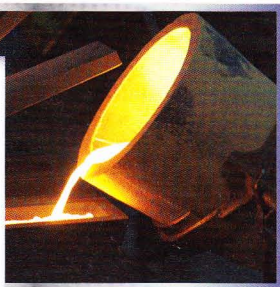
6 Write a summary of the texts in exercises 1 and 4 following the flow chart.



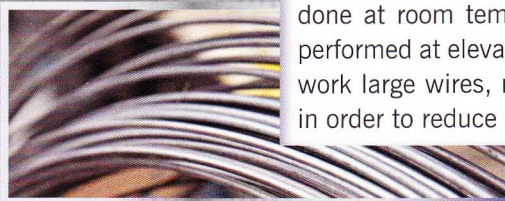
Metal processes

7  2 Listen and complete the texts about the different processes metals can go through.

Casting is a 6,000 year old process. It is the oldest and most well-known technique based on three fundamental steps: moulding, melting and (1) _____. First the pattern is made to form the **mould**. Then an empty mould is created, and finally the empty cavity is filled with molten metal which is then left to solidify into the shape. Casting materials are usually (2) _____ but can also be plastic, resin or various cold materials for example (3) _____. Casting is usually used for making complex shapes.



Drawing is a manufacturing process for producing wires, **bars** and (4) _____ by pulling on material through a series of **dies** until it increases in length. It is divided into two types: sheet metal drawing, and wire, (5) _____, and **tube** drawing. Drawing is usually done at room temperature but it can be performed at elevated temperatures to hot work large wires, **rods** or **hollow** sections in order to reduce forces.



Forging is the process by which metal is heated and shaped by a compressive force using a **hammer** or a press. It is used to produce large quantities of identical parts, such as (6) _____ parts in the automobile industry. Cold forging is done at a low temperature using (7) _____ metals and plastic. Hot forging is done at a high temperature and makes metal easier to shape without breaking. In the past, forging was done by a **blacksmith** using a hammer. Nowadays industrial forging is done with (8) _____ powered by a machine.



8 Put the words in the correct order to make complete sentences.

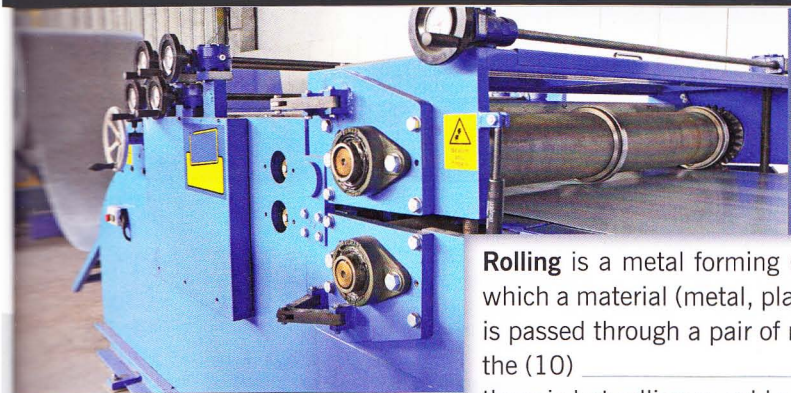
- 1 taking their forms / fluid substances / into moulds / solidify _____
- 2 drawing / room temperature / is done at _____
- 3 not essential / heat / is / in the drawing process _____
- 4 in the past / using / forging / a hammer / was done _____
- 5 can be / brittle materials / extrusion / done / with _____
- 6 many / is used / everyday objects / sheet forming / to make _____

9 Work in pairs. Read the texts again and write the correct processes that produce the objects listed below.

Product	Process
1 wires	_____
2 pasta	_____
3 sheet	_____
4 bricks	_____
5 tubes	_____
6 rods and bars	_____
7 golden leaves	_____
8 machine parts	_____
9 concrete	_____

10 Read the texts again and answer the following questions.

- 1 Which steps are included in casting?
- 2 What is the mould used for?
- 3 What does drawing use in order to process metals?
- 4 What types of drawing are there?
- 5 What kind of process is forging?
- 6 How was forging done in the past?
- 7 What does rolling consist of?
- 8 What materials can be used in rolling?
- 9 What are the advantages of extrusion?
- 10 What materials can be used in extrusion?
- 11 What kind of process is sheet metal forming?
- 12 What can vary in sheet metal forming?

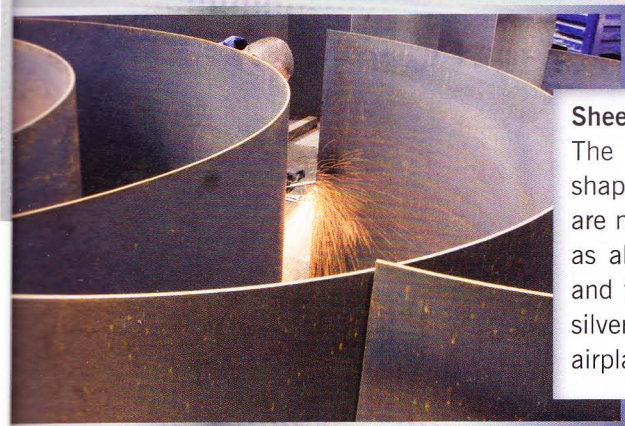
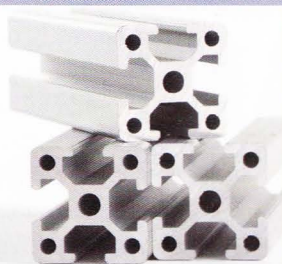


Rolling is a metal forming (9) _____ in which a material (metal, plastic, paper or glass) is passed through a pair of rollers. According to the (10) _____ of material rolled, there is hot rolling or cold rolling.



Extrusion is a process used to produce objects with a fixed cross-sectional profile. A material is pushed or drawn through a die of the desired cross-section. The two main (11) _____ of this process are its ability to create very complex cross-sections and work materials that are brittle. The extrusion process can be done with hot or cold materials. Commonly extruded materials include metals, polymers, (12) _____, concrete and foodstuffs.

Ceramic can also be formed into shapes via extrusion. Terracotta extrusion is used to produce **pipes**. Many modern **bricks** are also manufactured using a brick extrusion process. Extrusion is also used in (13) _____ processing. Products such as certain pastas, many breakfast cereals, French fries, dry pet food and ready-to-eat snacks are mostly manufactured by extrusion.



Sheet metal forming is simply metal formed into thin and **flat** pieces. The basic forms can be cut and **bent** into a variety of different shapes. Everyday objects are constructed with this process. There are many different metals that can be made into sheet metal, such as aluminium, (14) _____, copper, steel, tin, nickel and titanium. For decorative uses, important sheet metals include silver, gold, and platinum. Sheet metal forming is used in car bodies, airplane wings and roofs for (15) _____.

MY GLOSSARY

alloy /æləʊ/ _____
 aluminium /æljʊ'mɪniəm/ _____
 bar /bɑ:(r)/ _____
 bent /bent/ _____
 blacksmith /blæksmɪθ/ _____
 brass /brɑ:s/ _____
 brick /brɪk/ _____
 brittle /brɪtl/ _____
 bronze /brɒnz/ _____
 cable /keɪbl/ _____
 carbon /kɑ:bn/ _____
 casting /kɑ:stɪŋ/ _____
 concrete /kɒŋkri:t/ _____
 copper /kɒpə(r)/ _____
 die /daɪ/ _____
 drawing /drɔ:ɪŋ/ _____
 extrusion /ɪk'stru:ʒn/ _____
 flat /flæt/ _____
 hammer /hæmə(r)/ _____

hollow /hɒləʊ/ _____
 to improve /tu: ɪm'pru:v/ _____
 to insulate /tu: ɪn'sjuleɪt/ _____
 machinery /mæ'ʃɪnəri/ _____
 mould /məʊld/ _____
 to oxidise /tu: ɒksɪdaɪz/ _____
 pipe /paɪp/ _____
 plastic /plæstɪk/ _____
 rod /rɒd/ _____
 rolling /rɒlɪŋ/ _____
 rubber /rʌbə(r)/ _____
 shape /ʃeɪp/ _____
 sheet /ʃi:t/ _____
 steel /sti:l/ _____
 tin /tɪn/ _____
 tool /tu:l/ _____
 tube /tju:b/ _____
 wire /waɪə(r)/ _____
 zinc /zɪŋk/ _____