

3

Engineering materials



Ribbed plastic pipes stacked near a road construction site where they will be laid for drainage along the sides of a new section of motorway.

Tuning-in

Task 1

List the materials you know which are used in engineering. Combine your list with the others in your group and classify the materials as metals, thermoplastics, etc.

Reading *Scanning tables*

In engineering it is important to practise reading tables, charts, diagrams, and graphs because so much information is presented in these ways. We will start in this unit with a table.

Scanning is the best strategy for finding information in a table. With scanning, you know before you read what sort of information you are searching for. To scan a table, you move your eyes up and down the columns until you find the word or words you want. To scan quickly, you must learn to ignore any information which will not help you with your task.

Task 2

Scan the table which follows to find a material which is:

- 1 soft
- 2 ductile
- 3 malleable
- 4 tough
- 5 scratch-resistant
- 6 conductive and malleable
- 7 durable and hard
- 8 stiff and brittle
- 9 ductile and corrosion-resistant
- 10 heat-resistant and chemical-resistant

Materials	Properties	Uses
Metals		
Aluminium	Light, soft, ductile, highly conductive, corrosion-resistant.	Aircraft, engine components, foil, cooking utensils
Copper	Very malleable, tough and ductile, highly conductive, corrosion-resistant.	Electric wiring, PCBs, tubing
Brass (65% copper, 35% zinc)	Very corrosion-resistant. Casts well, easily machined. Can be work hardened. Good conductor.	Valves, taps, castings, ship fittings, electrical contacts
Mild steel (iron with 0.15% to 0.3% carbon)	High strength, ductile, tough, fairly malleable. Cannot be hardened and tempered. Low cost. Poor corrosion resistance.	General purpose
High carbon steel (iron with 0.7% to 1.4% carbon)	Hardest of the carbon steels but less ductile and malleable. Can be hardened and tempered.	Cutting tools such as drills, files, saws
Thermoplastics		
ABS	High impact strength and toughness, scratch-resistant, light and durable.	Safety helmets, car components, telephones, kitchenware
Acrylic	Stiff, hard, very durable, clear, can be polished easily. Can be formed easily.	Aircraft canopies, baths, double glazing
Nylon	Hard, tough, wear-resistant, self-lubricating.	Bearings, gears, casings for power tools
Thermosetting plastics		
Epoxy resin	High strength when reinforced, good chemical and wear resistance.	Adhesives, encapsulation of electronic components
Polyester resin	Stiff, hard, brittle. Good chemical and heat resistance.	Moulding, boat and car bodies
Urea formaldehyde	Stiff, hard, strong, brittle, heat-resistant, and a good electrical insulator.	Electrical fittings, adhesives

Task 3

Scan the table to find:

- 1 A metal used to make aircraft
- 2 Plastics used for adhesives
- 3 Steel which can be hardened
- 4 An alloy suitable for castings
- 5 A plastic with very low friction
- 6 A material suitable for safety helmets
- 7 A metal suitable for a salt-water environment
- 8 A metal for general construction use but which should be protected from corrosion
- 9 A plastic for car bodies
- 10 The metal used for the conductors in printed circuit boards

Language study *Making definitions*

Study these facts from the table about aluminium:

- 1 Aluminium is a light metal.
- 2 Aluminium is used to make aircraft.

We can link these facts to make a definition of aluminium:

1+2 *Aluminium is a light metal **which** is used to make aircraft.*

Task 4

Use the table on the previous page to make definitions of each of the materials in column **A**. Choose the correct information in columns **B** and **C** to describe the materials in column **A**.

A	B	C
1 An alloy		allows heat or current to flow easily
2 A thermoplastic		remains rigid at high temperatures
3 Mild steel		does not allow heat or current to flow easily
4 A conductor	a metal	contains iron and 0.7% to 1.4% carbon
5 An insulator	a material	becomes plastic when heated
6 High carbon steel	an alloy	contains iron and 0.15% to 0.3% carbon
7 Brass		formed by mixing other metals or elements
8 A thermosetting plastic		consists of copper and zinc

Writing *Adding information to a text*

Study this text about aluminium.

Aluminium is used to make aircraft, engine components, and many items for the kitchen.

We can add extra information to the text like this:

Aluminium, **which is light, soft, and ductile**, is used to make aircraft, engine components – **for example, cylinder heads** – and many items for the kitchen, **such as pots**.

Note that the extra information is marked with commas or dashes:

, *which ...* ,

– *for example, ...* –

, *such as ...* ,

Task 5

Add this extra information to the following text about plastics.

- 1 Plastics can be moulded into plates, car components, and medical aids.
- 2 Thermoplastics soften when heated again and again.
- 3 Thermosetting plastics set hard and do not alter if heated again.
- 4 ABS is used for safety helmets.
- 5 Nylon is self-lubricating.
- 6 Nylon is used for motorized drives in cameras.
- 7 Acrylic is a clear thermoplastic.
- 8 Acrylic is used for aircraft canopies and double glazing.
- 9 Polyester resin is used for boat and car bodies.
- 10 Polyester resin is hard and has good chemical and heat resistance.

Plastics are synthetic materials. They can be softened and moulded into useful articles. They have many applications in engineering. There are two types of plastics: thermoplastics and thermosetting plastics.

ABS is a thermoplastic which is tough and durable. Because it has high impact strength, it has applications where sudden loads may occur.

Nylon is a hard, tough thermoplastic. It is used where silent, low-friction operation is required.

Acrylic can be formed in several ways. It is hard, durable, and has many uses.

Polyester resin is a thermosetting plastic used for castings. It has a number of useful properties.