

Metals

Ferrous Metals- Ferrous metals are made up of iron and almost all of them are magnetic.

Metal	Properties	Uses
Cast iron	Very strong if compressed, but brittle and not malleable.	Bench vices, car brake disks, manhole covers.
Low Carbon Steel (also known as Mild Steel)	Quite strong and cheap, but rusts easily and can't be hardened.	Car bodies, screws, nuts, bolts, nails, washing machines.
High Carbon Steel (also known as Tool Steel)	Harder than low-carbon steel, can be hardened. Not as easy to work though and it rusts.	Tools, e.g. chisels, files, saws, drills.

Non- Ferrous Metals- Non- Ferrous metals don't contain iron, so don't rust. Useful if they're likely to be exposed to moisture. Some are alloys.

Metal	Properties	Uses
Aluminium	Lightweight, corrosion- resistant, expensive, hard to join, not as strong as steel.	Aeroplanes, can, ladders.
Brass (65% Copper and 35% Zinc)	Quite strong, corrosion- resistant, malleable, ductile, good colour (golden bronze)	Electrical parts, door handles, taps.
Copper	Relatively soft, malleable, ductile, very good electrical conductor.	Electrical wiring, pipes.
Tin	Soft, corrosion- resistant, malleable, ductile, low melting point.	Foil, tin cans, alloying metal in solder.
Zinc	Not very strong, corrosion- resistant	Coating steel (e.g. on nails, buckets and watering cans.

Alloys- Alloys are formed when one or more elements are combined with a metal.

High Speed Steel

- Contains iron, carbon and other metals including chromium, tungsten and vanadium.
- It keeps its hardness when heated to high temperatures, so is used in high speed cutting tools.

Brass (copper and zinc)

- Harder and stronger than both copper and zinc separately.
- It is malleable, ductile, good electrical conductor, resistant to corrosion.

Stainless steel (iron + carbon + chromium + nickel)

- Cast iron and mild steel (iron + carbon) are stronger but rust easily.
- Adding chromium and nickel increases strength, toughness and ductility. It decreases rust.
- It is used in surgical equipment, sinks and cutlery.

Properties of Metal-

Hardness: stiffness, resistance to bending, scratching, abrasion, or cutting.

Elasticity: the ability of material to resume its normal shape after being stretched or compressed.

Conductivity: the amount to which a material conducts electricity.

Toughness: How well the material can resist fracturing when force is applied.

Ductility: Easily stretched without breaking.

Tensile Strength: the resistance of a material to breaking under tension

Malleability: capable of being extended or shaped by beating with a hammer or by the pressure of rollers.

Name: _____

Forces and stresses-

Forces act on materials all the time - even if a material appears stationary it still has a force acting on it. There are five terms used to describe what type of force can act on a material:

Tension (a pulling force)- Tension can be tested by pulling opposite ends of the metal. The tensile strength can be tested to see if the chosen metal will be fit for purpose by fixing a piece of metal to a point and then loading it with a pulling force.

Compression (a pushing force)- Compression can be tested by applying a force on top of the piece of metal. If the metal compresses, then reinforcing the metal could be an option.

Bending (forces at an angle to the material)

Torsion (a twisting force)- Torsion can be tested by securing the end of the metal in a vice. The other end can then be twisted to see if the metal can withstand the force. If there is a twist, bracing one piece of metal to another can prevent deformation due to both torsion and shear forces.

Shear (forces acting across the material)- Shear forces act in different directions and cut across a material, but a huge amount of force is needed to shear through a piece of metal. If a piece of metal is cut using tin snips, the cut will have been made by a shear force.

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High Speed Steel

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Stainless steel (iron + carbon + chromium + nickel)

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Elasticity:

Conductivity:

Toughness:

Ductility:
Tensile Strength

Malleability:

Forces and stresses-

Tension (a pulling force)-

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Bending (forces at an angle to the material)

Torsion (a twisting force)-

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