



## 1.8 — Ferrous and Non-Ferrous Metals

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Cornell Notes

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Chapter: 1.8

### Key Words & What They Mean

<b><u>Ferrous metal</u></b>	A <b><u>ferrous</u></b> metal contains iron.
<b><u>Non-ferrous metal</u></b>	A <b><u>non-ferrous</u></b> metal does not contain iron.
<b><u>Alloy</u></b>	An <b><u>alloy</u></b> is made by mixing two or more metals together.
<b><u>Ductility</u></b>	<b><u>Ductility</u></b> means a metal can be stretched into wire without breaking.
<b><u>Malleability</u></b>	<b><u>Malleability</u></b> means a metal can be hammered flat without cracking.
<b><u>Hardness</u></b>	<b><u>Hardness</u></b> means a material resists being scratched or dented.
<b><u>Elastic deformation</u></b>	<b><u>Elastic</u></b> deformation means the metal springs back to its original shape.
<b><u>Plastic deformation</u></b>	<b><u>Plastic</u></b> deformation means the metal stays in its new shape permanently.
<b><u>Mohs scale</u></b>	The <b><u>Mohs scale</u></b> measures hardness from 1 (softest) to 10 (hardest).

### Working Properties — What Can the Metal Do?

<b><u>Ductility</u></b>	A <b><u>ductile</u></b> metal can be pulled into a thin wire without snapping.
<b><u>Malleability</u></b>	A <b><u>malleable</u></b> metal can be hammered or rolled flat without cracking.
<b><u>Hardness</u></b>	A <b><u>hard</u></b> material resists scratches, dents and general wear.
<b><u>Tensile strength</u></b>	<b><u>Tensile strength</u></b> means the metal can be pulled without breaking.
<b><u>Toughness</u></b>	A <b><u>tough</u></b> material can take a knock or impact without cracking.
<b><u>Corrosion resistance</u></b>	A <b><u>corrosion resistant</u></b> metal does not rust or rot easily.
<b><u>Conductivity</u></b>	A <b><u>conductive</u></b> metal lets heat or electricity pass through it.
<b><u>Machinability</u></b>	A <b><u>machinable</u></b> metal is easy to cut, drill or shape with tools.

### Main Notes — Specification Point vs What It Means

<b>1.8 What You Need to Know</b>	<ul style="list-style-type: none"> <li>You need to learn the <b>properties</b> of each metal.</li> <li>You must choose the <b>right metal</b> for the job.</li> </ul>
<b>1.8.1 Ferrous Metals</b> What are they?	<ul style="list-style-type: none"> <li>Ferrous metals all contain <b>iron</b>.</li> <li>Most ferrous metals are <b>magnetic</b>.</li> <li>Most ferrous metals will <b>rust</b> when they get wet.</li> <li>Stainless steel is a ferrous metal that does <b>not rust</b>.</li> </ul>
<b>1.8.1a Mild Steel</b>	<ul style="list-style-type: none"> <li>Mild steel is iron with a small amount of <b>carbon</b> added.</li> <li>It is strong and easy to <b>weld</b> and join.</li> <li>It has <b>poor corrosion resistance</b> and will rust without protection.</li> <li>It is used for <b>screws</b>, nails, bolts, car body panels and girders.</li> </ul>
<b>1.8.1b Stainless Steel</b>	<ul style="list-style-type: none"> <li><b>Chromium</b> is added to stop stainless steel from rusting.</li> <li>It is very <b>hard</b> and difficult to cut.</li> <li>It is used for <b>cutlery</b>, sinks, kitchenware and medical tools.</li> </ul>
<b>1.8.1c Cast Iron</b>	<ul style="list-style-type: none"> <li>Cast iron has a lot of <b>carbon</b> in it.</li> <li>It is very hard but also very <b>brittle</b> — it can snap if hit.</li> <li>It is used for <b>manhole covers</b>, brake discs and machine parts.</li> </ul>
<b>1.8.2 Non-Ferrous Metals</b> What are they?	<ul style="list-style-type: none"> <li>Non-ferrous metals do not contain <b>iron</b>.</li> <li>They do not <b>rust</b> or corrode easily.</li> <li>They are <b>not magnetic</b>.</li> <li>They are usually more <b>malleable</b> than ferrous metals.</li> </ul>
<b>1.8.2a Aluminium</b>	<ul style="list-style-type: none"> <li>Aluminium is very <b>lightweight</b> for its strength.</li> <li>It resists <b>corrosion</b> and does not rust.</li> <li>It conducts <b>heat and electricity</b> very well.</li> <li>It is used for <b>aircraft</b>, drinks cans, foil and window frames.</li> </ul>
<b>1.8.2b Copper</b>	<ul style="list-style-type: none"> <li>Copper is a <b>reddish-brown</b> coloured pure metal.</li> <li>It is the best common metal for conducting <b>electricity</b>.</li> <li>It is used for <b>electrical wire</b>, water pipes and roofing.</li> </ul>
<b>1.8.2c Brass</b>	<ul style="list-style-type: none"> <li>Brass is an <b>alloy</b> made from copper and zinc.</li> <li>It is <b>harder</b> than pure copper.</li> <li>It is used for <b>plumbing</b> fittings, locks and musical instruments.</li> </ul>
<b>1.8.3 Ductility</b>	<ul style="list-style-type: none"> <li>A <b>ductile</b> metal can be stretched into wire without snapping.</li> <li>Ductility gets better when the metal is <b>heated</b>.</li> <li>All ductile metals are also <b>malleable</b>, but not the other way around.</li> </ul>

<b>1.8.3 Malleability</b>	<ul style="list-style-type: none"> <li>• A <b>malleable</b> metal can be hammered flat without cracking.</li> <li>• Malleability gets better when the metal is <b>heated</b>.</li> <li>• <b>Copper</b> is a great example of a very malleable metal.</li> </ul>
<b>1.8.3 Hardness</b>	<ul style="list-style-type: none"> <li>• A <b>hard</b> material resists scratches, drilling and wear.</li> <li>• Hard materials are often <b>brittle</b> and can snap if hit hard.</li> <li>• <b>Diamond</b> is the hardest natural material — it scores 10 on the Mohs scale.</li> <li>• Most steels score between 5 and 8.5 on the <b>Mohs scale</b>.</li> </ul>
<b>1.8.3 Elastic vs Plastic Deformation</b>	<ul style="list-style-type: none"> <li>• <b>Elastic</b> deformation means the metal springs back to its original shape.</li> <li>• <b>Plastic</b> deformation means the metal stays in its new shape.</li> <li>• Building metals need to be a little <b>elastic</b> so they flex without breaking.</li> </ul>

## Summary — The Big Ideas to Remember

<p>Metals that contain iron are called <b>ferrous</b> metals.</p>
<p>Metals that do not contain iron are called <b>non-ferrous</b> metals.</p>
<p>A mix of two or more metals is called an <b>alloy</b>.</p>
<p>The main ferrous metals are <b>mild steel</b>, stainless steel and cast iron.</p>
<p>The main non-ferrous metals are <b>aluminium</b>, copper and brass.</p>
<p>The three main properties to learn are <b>ductility</b>, malleability and hardness.</p>
<p>Hard metals tend to be <b>brittle</b> and can snap if hit hard.</p>
<p>Always match the metal's <b>properties</b> to what the product actually needs.</p>