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# Core Content D&T GCSE Key Learning

# Metals

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This resource has been formatted as an A4 page to make it easier to print slides as handouts. If other formats are required changes can be made in the settings.

The content of this resource can be edited to suit the context of the user.

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# About this resource

- This resource summarises key learning for metals for the D&T GCSE core content. Learning is relevant to all exam boards but users should check their specification to identify materials relevant to them and to identify any additional materials that should be considered.
- The focus of this resource is the key learning for the D&T GCSE core content:
  - All specifications: categorization, names, properties, uses
  - Some specs also include: sources/raw material, finishes, stock forms

  (Note that for the core content students don't need to know how to 'make' using all materials, although practical activities are a good way for students to engage in the learning)
- This resource is part of a series covering each D&T material area and there's a common format across the resources. Resources include:
  - Knowledge-based slides: one summarising basic information in a visual format, one with more detailed background information (not all detail is relevant to D&T GCSE but gives context to the learning), and one summarising material properties.
  - Retrieval activities: revision cards for summarising key learning, an activity where students identify products and their materials, and a 'knowledge drop' activity where students retrieve as much knowledge as they can within a short timescale. This activity can be structured e.g. timed slot with keywords hidden, additional time with keywords visible as a prompt (with new additions in a different colour) and a third time slot where students pair up to share ideas. The logos on this activity prompt analytical thinking and the 'top tips' and 'writing questions' sections encourages deeper and application of knowledge in a broader context.

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# Metal Family

## Ferrous

Ferrous indicates the presence of iron.
Ferrous metals include steel and pig iron, with small amounts of carbon added, as well as alloys of iron, with other metals (such as stainless steel).
Properties include magnetism and rusting.

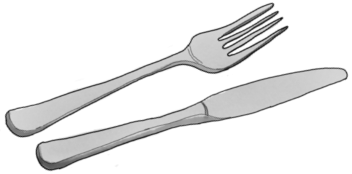
Low carbon steel/Mild steel: Screws, girders, nails, car bodies
High carbon steel/Tool steel: Workshop tools, scissors, metal cutting tools
Iron/Cast iron: Cooking pans, vices, manhole covers, post box

## Non-ferrous

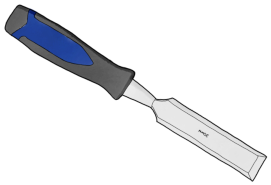
More expensive than ferrous metals, non-ferrous metals are used because of desirable properties such as low weight (e.g. aluminium) and higher conductivity (e.g. copper). Non ferrous metals also don't rust.

Aluminium: Pots & pans, sports cars, bike frames, drink cans, foil take-away trays
Copper: Plumbing supplies, electrical cables
Tin: Can production, soft solder
Brass: Plumbing fitments, ornate artifacts, musical instruments

Stainless steel

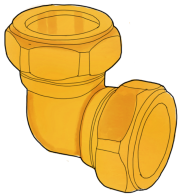


High carbon steel

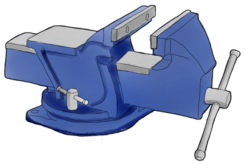


Aluminium

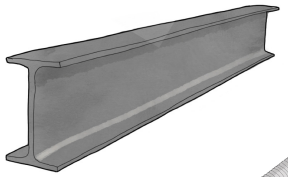

Brass

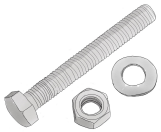


Iron

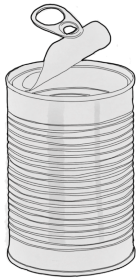


Mild steel

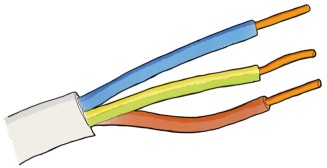




Tin



Copper



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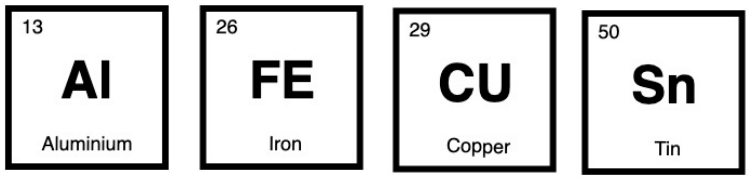
# Metals

- Metal occurs naturally & is **mined** from the ground as **ore** which is rock containing pure metal. Furnaces are used to extract the metal as a molten liquid.
- Processing metal takes a lot of energy but most can be recycled.
- Metals can be categorised into **ferrous** and **non-ferrous.**

Describe Me

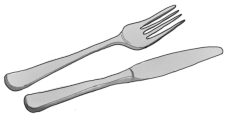



The periodic table classifies different elements, including pure metals. The code for iron is 'FE' & this can be a useful revision tool as these are the first two letters of 'ferrous' & ferrous metals are ones that contain iron.

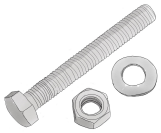
Sketch Me

**Ferrous**

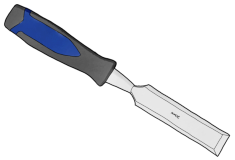
Iron



Stainless steel



Mild steel

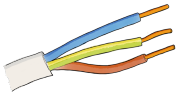


High carbon steel

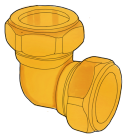
**Non-ferrous**

Tin

Aluminium

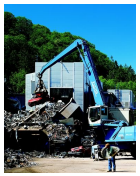


Copper



Brass

Give Examples



Processing metal takes a large amount of energy which is why metals like aluminium are regularly recycled e.g. 95% less energy is used to recycle aluminium than producing the raw material. This also saves natural resources & reduces the amount of metal that needs to be imported from abroad.

Evaluate Me

- Ferrous metals contain iron & most are **magnetic**
- Ferrous metals carbon content means they tend to **rust** when exposed to moisture and oxygen.
- The amount of carbon in ferrous metals impacts on how hard & **malleable** the metal is.
- Non ferrous metals don't contain iron & are more malleable, more resistant to corrosion & most are not magnetic.
- Non ferrous metals are more expensive than ferrous metals but they have desirable properties e.g. low weight, high **conductivity** & not rusting.

Compare Me

Copper **oxidises**, which means the surface changes colour over time. The thin oxide layer is called patina & Verdigris is the name given to the green colour change. This is often used by designers & architects e.g. when designing roofing or on parts of buildings like the dome in the image.

**Alloys** are man made metals that have been combined with a metal or a non metal to improve the properties or appearance of the original materials e.g. brass, steel, pewter.

Precious metals such as gold, silver & platinum, lead & mercury are also non ferrous metals. Lead & mercury are poisonous.

What If....

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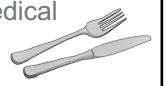
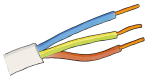
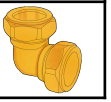
# Properties of Metal

| | Type of metal | Properties | Uses |
|---|---|---|---|
| **Ferrous metals** Ferrous metals contain iron, are magnetic & rust if exposed to moisture without a protective finish. Carbon is commonly added to ferrous metals to increase the hardness of the iron. | Mild steel (low carbon steel) | Tough, ductile, poor corrosion resistance, high tensile strength, malleable, magnetic | Girders, car body panels & bike frames, nails, screws, bolts  |
| | High carbon steel (tool steel) | Similar to low carbon steel but less ductile and doesn't rust as easily, hard but also brittle, smooth texture | Tools e.g. screwdrivers, tap and dies, chisels, blades, scissors  |
| | Stainless steel (steel, chromium & nickel alloy) | Tough, resists corrosion, hard, can be magnetic, resists wear and tear, can be hard to cut | Sinks, industrial work surfaces in kitchens, cutlery, medical equipment  |
| | Cast iron | Brittle, hard skin but soft core, magnetic, self lubricates, strong | Manhole covers, post boxes, vices, brake discs, machine parts  |
| | High speed steel (alloys can include chromium, Tungsten, Cobalt, Carbon) | Can withstand high temperatures, high resistance to wear, tough | Drill bits & cutting tools  |
| **Non-ferrous metals** Non-ferrous metals don't contain iron, are not magnetic & don't rust. . | Aluminium | Lightweight, good strength to weight ratio, ductile, malleable, resists corrosion | Pans, drink cans, car body panels and bike frames, takeaway trays, foil, aircraft bodies  |
| | Copper | Oxidises to a green colour unless treated, very ductile, malleable, conductive, corrosion resistant | Green colouring after oxidisation is used by architects e.g. for roofing, pipes, electric cables, hot water tanks  |
| | Tin | Soft, malleable, ductile, conductive, low melting point, good corrosion resistance | Tin cans, solder, alloyed with copper to create bronze  |
| | Pewter | Low melting point, malleable, ductile, good corrosion resistance, not magnetic | Jewellery, candlesticks, tankards, outdoor lights, decorative homeware  |
| | Zinc | Conductive, malleable, ductile, very corrosion resistant, low melting point | Mainly used to add a galvanised finish to steel to prevent rusting  |
| | Brass (copper & zinc alloy) | Strong, ductile, resists corrosion, conductive, oxidises to a dark brown, malleable | Taps & plumbing, musical instruments  |

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# Revision Cards: Metals

| Material name & sample or photo | Classification e.g. ferrous, non-ferrous | Stock forms e.g. standard sizes |
|---|---|---|
| Uses | Properties e.g. physical properties, working properties | |
| Finishes e.g. something added to the surface to change the properties | Sustainability e.g. impact on the environment | |
| Other important information & useful images | | |


| Material name & sample or photo | Classification e.g. ferrous, non-ferrous | Stock forms e.g. standard sizes |
|---|---|---|
| Uses | Properties e.g. physical properties, working properties | |
| Finishes e.g. something added to the surface to change the properties | Sustainability e.g. impact on the environment | |
| Other important information & useful images | | |

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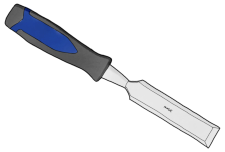
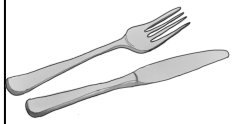
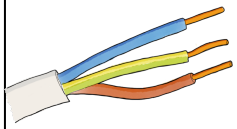
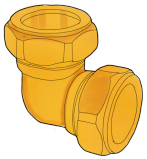
# What type of metal am I made from?

| Product | Type of metal | Properties that make it a suitable choice for the product | Product | Type of metal | Properties that make it a suitable choice for the product |
|---|---|---|---|---|---|
|  Drinks can | | |  Chisel | | |
|  Cutlery | | |  Screws, nuts and bolts | | |
|  Electrical wire | | |  Post box | | |
|  Food can | | |  Girder | | |
|  Pipe fittings | | | Name another example of a product made from metal | | |

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# Ferrous & Non - Ferrous Metals

Categorization | Source | Uses | Properties | Ferrous | Non-ferrous

1. Cover up the keywords.
2. Set a time limit e.g. 5 minutes and summarise in this box what you know about ferrous and non-ferrous metals.
3. When you've written as much as you can, use the keywords to help you add to your notes.

4. What top tips would you give yourself e.g. common mistakes & key things to remember

5. On the back of this sheet write examples of questions that test your knowledge.

You could write your own questions or find examples of past exam questions.


Alloy | Cast iron | Mild steel | Low carbon steel | Stainless steel

High speed steel | Pewter | Brass | Zinc

Bronze | Tin | Copper | Aluminium | High carbon steel

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