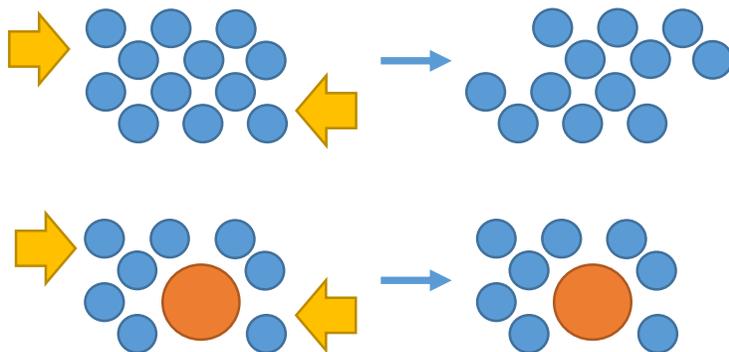


Keyword	Definition
Transition metal	A metal element in the block between groups 2 and 3 of the periodic table.
Alloy	A metal with one or more other elements added (usually metals) to improve its properties (eg hardness).
Corrosion	The gradual deterioration of a substance when it reacts with substances in the environment. (eg when a metal oxidises in the air).
Sacrificial protection	Using a more reactive metal to protect another metal from corrosion (eg attaching zinc blocks to iron to prevent the iron rusting).
Compound	A substance that can be split into simpler substances because it contains atoms of two or more elements chemically joined together.

Alloys

- Pure metals are malleable due to the regular arrangement of ions in layers that can easily slide over each other
- Some pure metals are not strong enough for certain uses
- Adding another element to a pure metal that has a different size disrupts the regular arrangement of metal ions and makes it difficult for the ions to slide over each other - creating a harder material



Transition metals

- The majority of metals are transition metals
- A transition metal typically has the following properties: high melting point, high density, forms coloured compounds (eg Fe^{2+} is green, Fe^{3+} is orange-brown) and can be used as a catalyst (eg Fe is the catalyst for the Haber process for making ammonia)

Alloys of aluminium

- Aluminium has a low density which is suitable for aircraft manufacturing but is not strong enough when pure. Alloys can increase the strength of aluminium without increasing its density.
- Magnalium (aluminium + magnesium) – at 5% magnesium magnalium is suitable for aircraft manufacturing. It is stronger, less dense and more corrosion resistant than pure aluminium.

Alloys of copper

- Bronze (copper + tin) – harder than copper. Used for decorative items such as medals, ornaments and statues
- Brass (copper + zinc) – more malleable than bronze. Used where low friction is needed such as in water taps and door fittings

Alloys of gold

- Gold is used to make jewellery – when pure it is very soft and malleable.
- Metals such as zinc, copper and silver are used to make gold alloys that are harder than pure gold and have a different colour.

Alloys of iron

- Alloys of iron, called steels, have different properties depending on what is added to the iron.
- Adding carbon to iron produces steel. It is harder than iron.
- Adding carbon and another metal produces a steel alloy. Adding chromium (and sometimes nickel) produces stainless steel. Unlike iron, stainless steel is resistant to corrosion.



Corrosion

- Most metals will corrode when exposed to oxygen and water to form metal oxides.
- Corrosion of metals is a redox reaction. The metal is oxidised (it loses electrons) and oxygen is reduced (it gains electrons).

Corrosion – Prevention of rusting

- Rusting is the corrosion of iron. Both oxygen and water are required for rusting to happen. Preventing either of these from contacting the iron will stop rusting.
- Coating the iron with a barrier will prevent it from rusting. Paint prevents rusting for non-moving parts and oil/grease can be used for moving parts like bike chains.
- A more reactive metal than iron (eg zinc) can be used as a sacrificial protection by attaching it to the iron. Electrons are taken from the zinc in preference to the iron preventing rusting.
- Galvanising is an example of sacrificial protection. A barrier of a more reactive metal is coated over the iron (eg steel buckets are often galvanised).

Corrosion prevention - Electroplating

- Electroplating is process of coating the surface of a metal object with another metal using electrolysis.
- Electroplating is typically carried out to improve corrosion resistance or the appearance of the metal object
- Gold and silver plated objects (eg jewellery) can be made this way.
- The cathode (negatively charged) is the object to be plated and the anode (positively charged) is a bar of the metal that will form the plate. The electrolyte contains ions of the metal that will form the plate.