The content on this sheet is assessed on paper 1 only.

Qualitative Analysis (Separate)

* Indicates that these are some examples only: you could be asked about any substance / reaction.

5.1—Typical properties of transition metals

Transition metals tend to:

a) have high melting points (due to the strong electrostatic forces between the positive cations and sea of delocalised electrons needing high amounts of energy to overcome them).

b) have high density.

c) form coloured compounds (non-transition metals tend to form white compounds).

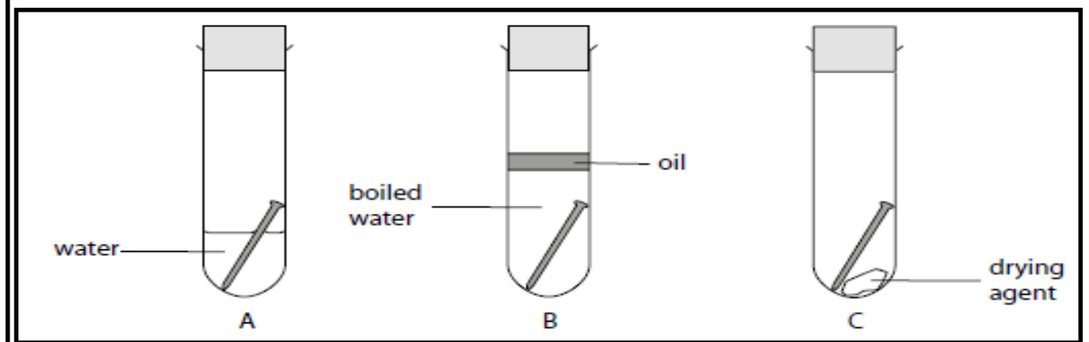
d) act as catalysts for reactions. Different reactions will have different catalysts.

5.2—Corrosion of metals

Corrosion is caused by metals being oxidised, often by reaction with oxygen in the air and in water

5.3—Prevention of rusting

The **only** metal that can rust is iron. Other metals are said to corrode.



In the diagram, only the nail in test tube A will rust. This is because it is exposed to both oxygen and water.

The nail in test tube B is not exposed to oxygen, so cannot rust (boiling water removes any dissolved gases from it).

The nail in test tube C is not exposed to water, so cannot rust (the drying agent absorbs moisture).

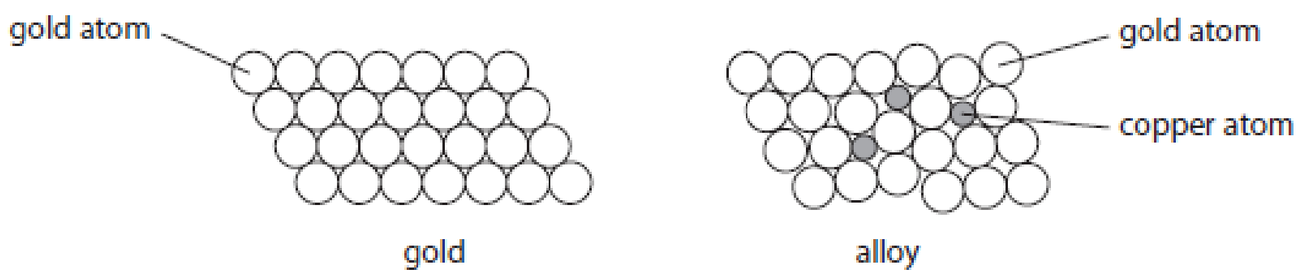
5.4—Electroplating

Electroplating is using the process of electrolysis to coat one metal in another. There are two main reasons:

a) to improve the appearance by coating in a more expensive (and often less reactive) metal. This often happens for metals that are used in jewellery: they are made of a cheaper metal, such as steel, then covered with gold or silver.

b) to improve the resistance to corrosion by coating in a more reactive metal (this is known as sacrificial protection). Zinc metal is often used for this, in a process known as galvanising. The more reactive zinc is coated over a less reactive metal, such as iron. The top layer corrodes first, meaning the metal structure of the iron lasts longer.

5.5—Alloying



In pure metals, all the metal cations are the same size. This means that, when a force is applied, the layers of cations can slide easily, making pure metals very malleable. *NB. You can interchange the word cations for atoms in this description.* (The electrons still hold the cations together, which is why the metal doesn't break).

In alloys, some of the cations are different sizes. This distorts the regular arrangement, so the layers cannot slide as easily, making alloys stronger than pure metals.

5.6—Steels

Steels are alloys made by mixing iron with other metals, or with carbon. The resulting steel's properties depends on the types of metals (and/or carbon) which has been added, as well at the amount of each.

Stainless steel is often used in cutlery and professional cookware. The iron is mixed with metals such as chromium. The chromium reacts with oxygen in air and water to produce a cover of chromium oxide, which prevents the iron from reacting with the oxygen. When it is scratched, more chromium reacts.

Mild steel is made by mixing iron with small amounts of carbon. It is relatively strong, but fairly easy to shape. It is used in construction and for making car body panels.

Alloy steels are harder still than mild steel, and can be used for lots of uses, depending on the properties of the specific alloy.

5.7—Uses of metals lined to their properties

Metal	Density, g cm^{-3}	Relative strength	Resistance to corrosion	Relative electrical conductivity
Aluminium	2.70	1.0	Very good	1.8
Copper	8.92	1.7	Very good	2.0
Gold	19.3	1.1	Excellent	1.9
Magnalium (Mg/Al alloy)	2.5	3.8	Very good	1.2
Brass (Cu/Zn alloy)	8.55	2.2	Good	1.6

Aluminium is used in overhead electrical cables: although it is not as good a conductor as copper, it is far less dense. Its low density, as well as its resistance to corrosion, is also the reason that it is used to make food and drinks cans. Both copper and gold have very high resistance to corrosion and are very good electrical conductors. Copper tends to be used in electrical wires, however, as it is much cheaper.

Magnalium is used for aircraft parts, due to its very high strength, resistance to corrosion and low density. Brass is used to make plug pins, rather than pure copper, due to its higher strength.

NB. The values used here are used for illustrative purposes only: they do not necessarily bear reference to actual values.