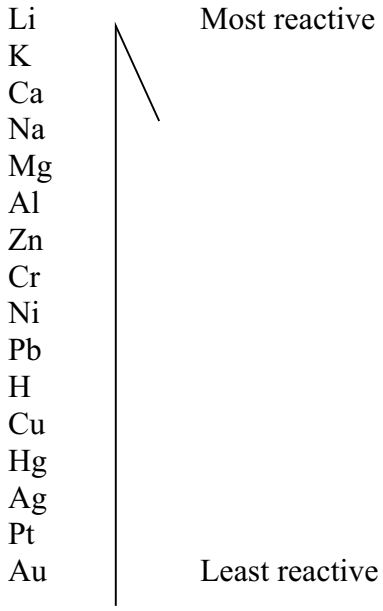
Activity Series

Metals react to form all kinds of substances. Their low ionisation energies and low elctronegativities means that they tend to easily lose their electrons to some other atom and form positive ions. These positive ions react to different degrees with other atoms. Their ability or willingness to combine with other elements is measured by their reactivity. Highly reactive metals are usually only found in nature as part of a compound. For example sodium is rarely found in its pure state. On the other hand, elements such as gold do not readily react and are more commonly found in a pure state. This property of gold explains why gold never tarnishes. The reactivity of metals is summarised in the **Activity Series** which starts at the top with the most reactive metals and ends with the least reactive.



The more reactive a metal is the greater is its ability to displace another metal from a substance.

e.g. $Zn(s) + CuSO_4 \text{ -----> } ZnSO_{4(aq)} + Cu_{(s)}$

Therefore the activity series can be used to predict what metals will displace other metals or whether a reaction will occur or not. If a metal A is higher in the table than another metal B, and both metals are mixed with another substance in a beaker, then metal A will react in preference to metal B. This explains one important trend. All the metals that are higher in reactivity than hydrogen will react with acids such as water, while metals below hydrogen will not.

Why is the activity series in this order? By experiment we have found this order for reactivity. You would think that the most electronegative and easily ionisable atoms would be at the top but this pattern does not completely hold true (e.g. Li is higher than

Mg). A metal's position is determined by its reactivity in solution. The processes that a metal must go through to get into solution make the trend a little more complex and depends on concepts that have not yet been taught involving the energy to dissolve, ionise and hydrate metals. So take my word for it that this is the way it is for now.

Halogen Activity Series

The halogens, like the metals, have varying degrees of reactivity. They have their own activity series but in the opposite expected order to the metals. Where the metals that were most reactive lost their electrons, the halogens that are the most reactive are the ones who most want electrons. The highly electronegative and small halogens tend to be at the top of the series while the big less electronegative atoms are at the bottom. The halogen activity series, like the metal activity series can also be used to predict whether a reaction will occur.