The group 13 elements comprise the elements Boron through Nihonium

The group 13 elements comprise the elements Boron through Nihonium in group 13 of the periodic table, as shown in Figure \(\PageIndex{1}\).

![Figure \(\PageIndex{1}\). Position of the group 13 elements in the periodic table. Note that since the periodic table used was developed element 113 was named Nihonium and given the symbol Nh. Adapted from the periodic table at https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_-_The_Central_Science_(Brown_et_al.)/02._Atoms%2C_Molecules%2C_and_Ions/2.5%3A_The_Periodic_Table](https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_-_The_Central_Science_(Brown_et_al.)/02._Atoms%2C_Molecules%2C_and_Ions/2.5%3A_The_Periodic_Table)

The group 13 elements are chemically diverse, comprising elements that are

- Boron, B, an electron deficient 2nd row element sometimes classified as a nonmetal and occasionally as a metalloid
- Aluminum, Al, an electron deficient 3rd row element sometimes classified as a metal and sometimes as a metalloid.
- Galium (Ga), Indium (In), Thalium (Tl), and Nihonium (Nh, marked under its old symbol, Uut, in the Figures on this page), post transition metals that exhibit the inert pair effect to varying degrees

The group 13 elements include post-transition metals.

The term **post-transition metals** refers to those elements that are metals follow the transition metals. As with the metalloid concept there is no universal consensus as to what exactly is a post transition metal. Fortunately, in practice it is less important to precisely define what is and is not a post transition metal than to understand the reason why it might be helpful to classify elements as a post-transition metal.

The main features of the post transition metals are that they are relatively electron rich and electronegative compared to what is classically thought of as a metal. Roughly, this translates into relatively lower melting points (since more antibonding levels in the band structure tend to be occupied), increased preference for covalency, and greater brittleness than other metals (due to the resulting directional bonding). Their electron richness means that they tend to form soft cations.
Several systems are used to classify elements as belonging to the post transition metals. The main ones include:

1. **Metals which follow the d-block.** By this definition only the metals in groups 13 and higher and Rows 3 and higher which form relatively soft and electron rich cations and exhibit significant covalency in their bonding are included. However, if this scheme is adopted too rigidly Al is excluded since it technically doesn’t follow the d-block (and has an unfilled (n-1)d subshell) and the metalloids are excluded, even though many of them also form relatively soft and electron rich cations with filled (n-1)d subshells. Another disadvantage of this system is that it entangles the issue of which elements should be classified as post-transition metals with the thorny issue of which elements should be classified as metals vs. metalloids.

2. **Metals and metalloids of the p-block.** This system has the advantage of emphasizing the interesting and unique properties of the metals and metalloids of p-block as well as continuities in those properties through the p-block. Consequently, it will be used in the sections which follow. However, it has the disadvantage of excluding metals like Zn, Cd, and Hg, which form many compounds in which the metal has a (n-1)d\(^{10}\) configuration.

3. **Metals which follow the transition elements in the sense of forming ions with a completely full (n-1)d valence shell sometimes along with Al and the p-block metalloids.** This definition adds Zn, Cd, and Hg (and sometimes Cu, Ag, and Au) since they form ions with an (n-1)d\(^{10}\) valence electron configuration such as Zn\(^{2+}\), Cd\(^{2+}\) and Hg\(^{2+}\) (and Cu\(^+\), Ag\(^+\), and Au\(^+\)). Since this chapter only considers the p-block elements for the purposes of this chapter this system is functionally identical to system 2.

Whichever classification scheme one uses it is often more helpful to think of the classification of elements as post-transition metals as a way to emphasize similarities in the chemical properties of a set of elements than as a way of emphasizing how post-transition metals differ from other metals. The post-transition metals are not the only ones which form soft cations or compounds better described as being held together by covalent bonds. As the previous sections made clear, even alkali metals form anions under the right circumstances and many compounds of metals are better described in terms of covalency than ionic interactions. This was already evident in the chemistry of the alkaline earth metals Be and Mg discussed in the previous section. In subsequent chapters the bonding and reactivity in coordination complexes and organometallic compounds will largely be described in covalent terms.

![Diagram showing elements classified as post-transition metals.](https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_-_The_Central_Science_(Brown_et_al.)/02,_Atoms%2C_Molecules%2C_and_Ions/2.5%3A_The_Periodic_Table.png)
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