

18.3: Cation Formation



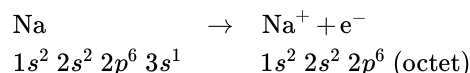
Figure 18.3.1(Public Domain; User:Bugman/Wikipedia via [Wikipedia](#))

How are cations formed?

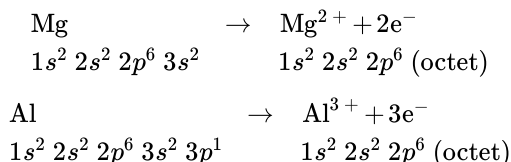
In many parts of the country, the water contains high concentrations of minerals that stain clothes, build up deposits on bathtubs and water heaters, and create problems with soap foaming properly. This problem is caused by "hard water". The water contains excessive amounts of cations such as iron and calcium. These ions create a lot of problems in the water. Ion exchange resins can remove these minerals and clean up the water.

Cation Formation

Cations are the positive ions formed by the loss of one or more electrons. The most commonly formed cations of the representative elements are those that involve the loss of all of the valence electrons. Consider the alkali metal sodium (Na). It has one valence electron in the third principal energy level. Upon losing that electron, the sodium ion now has an octet of electrons from the second principal energy level. The equation below illustrates this process.

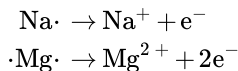


The electron configuration of the sodium ion is now the same as that of the noble gas neon. The term **isoelectronic** refers to an atom and an ion of a different atom (or two different ions) that have the same electron configuration. The sodium ion is isoelectronic with the neon atom. Consider a similar process with magnesium and with aluminum:



In this case, the magnesium atom loses its two valence electrons in order to achieve the same noble gas configuration. The aluminum atom loses its three valence electrons. The Mg^{2+} ion, the Al^{3+} ion, the Na^+ ion, and the *ceNe* atom are all isoelectronic. For representative elements under typical conditions, three electrons are the maximum number that will be lost.

We can also show the loss of valence electron(s) with an electron dot diagram:





Summary

- Cations form when an atom loses one or more electrons.
- The resulting cation has the electron configuration of the noble gas atom in the row above it in the periodic table.

Review

1. What is a cation?
2. How many valence electrons does the sodium atom have?
3. Which atom is the sodium ion isoelectronic with?
4. How many electrons does magnesium lose to form the magnesium ion?

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